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MONTANA AIR QUALITY DATA & INFORMATION SUMMARY FOR 1979-1980

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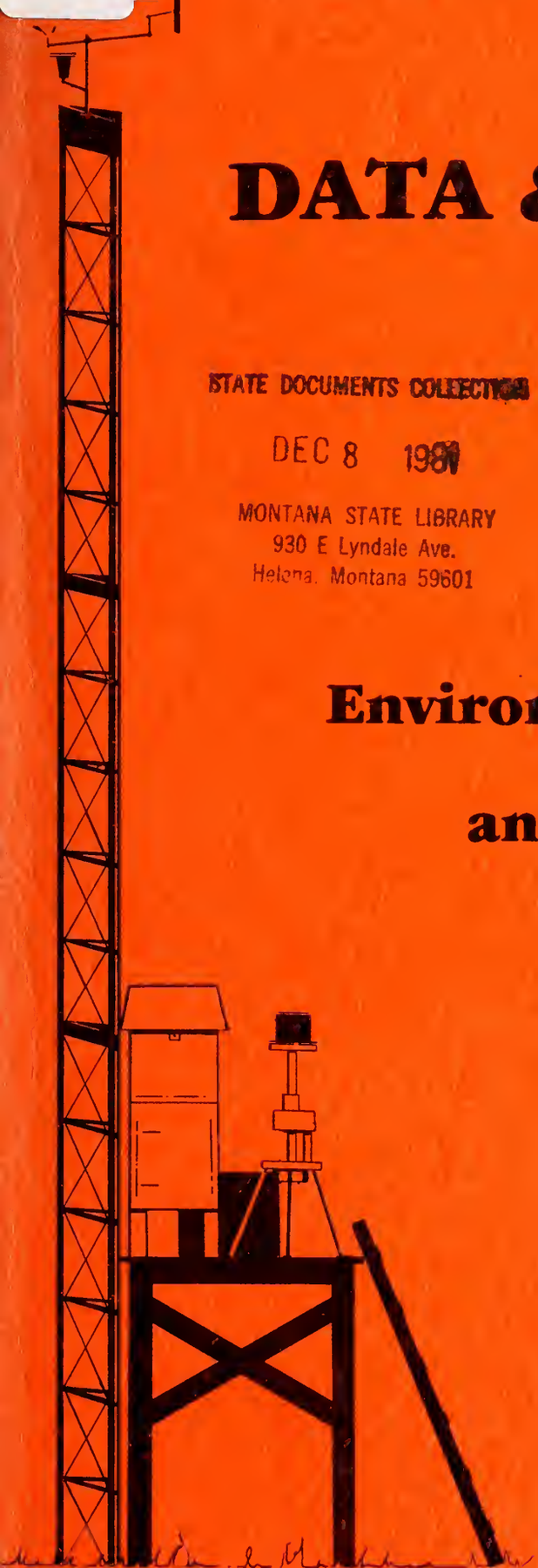

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MONTANA AIR QUALITY DATA AND INFORMATION SUMMARY FOR 1979-1980

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August, 1981

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I.
INTRODUCTION

I. INTRODUCTION

The Montana Air Quality Data and Information Summary for 1979-1980 serves two primary purposes. The first is to summarize air monitoring data from areas in the state; the second, to provide information on various air quality topics.

The data summary portion is intended as an overview of monitoring activities throughout the state for 1979 and 1980. For purposes of discussion, we have divided the state into ten study areas. Within each area we have provided the reader with various background information. This includes population growth or decline, climate and geography as it relates to air quality, and lists of possible air pollution sources. Following this information, we have tabulated the ambient data and made comments with regard to its significance.

The second portion of this report includes several appendices on a variety of topics relating to air quality. These include discussions on Prevention of Significant Deterioration, Attainment-Non Attainment, Ambient Air Quality Standards, Mount St. Helen's Ash emergency, Smoke Management and Visible Emission Documentation. Other miscellaneous tables, lists and short reports are included for the reader's benefit and informational needs.

In the past the Air Quality Bureau has published annual data summaries for 1976-1978. This report summarizes two years of data collection (1979-1980) and provides several informational appendices. Reporting two years of data has the added benefit of being able to compare one year to another.

The subject of air quality is often complicated and data intensive. It cannot be covered completely in any one report. We hope that this report will serve the needs of most data and information users.

II.
STUDY AREAS

II. STUDY AREAS

The data summary portion of this report is divided into ten study areas. Within each area, we have provided various background information. This includes population growth or decline; climate and geography; and listings of air pollution sources. For each study area, monitoring site descriptions are given and site locations are shown on an area map.

The ambient data is listed in various ways. Total suspended particulate (TSP) concentrations are tabulated showing annual geometric averages*, highest and second-highest daily concentrations. Tables of respirable particulates show annual averages and highest concentrations for each size classification. Continuous data are tabulated giving monthly averages and highest hourly concentrations. Metals, sulfates and nitrates are tabulated in the same manner as TSP. Tables of sulfation rate and fluoride give annual averages and the highest monthly average.

Table I lists all monitoring stations which were active in 1979 and 1980. Some stations didn't provide enough data for analysis but nevertheless are included to present the total monitoring network. Table II lists meteorological sites, locations, dates of operation and types of meteorological equipment operated at each site.

The data included in this report are a combined effort of the Air Quality Bureau (Montana Department of Health and Environmental Sciences), the Cascade County Air Pollution Control Agency, the Missoula City-County Health Department, and the Yellowstone County Air Pollution Control Agency.

*Annual averages for TSP are reported as a geometric average. We selected not to report an arithmetic average since the Montana Board of Health and Environmental Sciences did not adopt the arithmetic average standard until late in 1980. The Federal standard is a geometric average.

Table I

MONTANA AIR MONITORING STATIONS 1979-1980

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Anaconda	Lincoln School	*	*	*	*	*		*	*	*	*				*
Big Horn County	Thomas Ranch/Decker	*													
	**Warren Ranch/Hardin	*													
Billings	Lockwood	*	*	*	*	*	*	*	*						*
	KGHL	*					*								
	City Hall	*					*								
	Grand Ave. School	*					*								
	Garden Ave.						*								
	County Offices						*								
	Bench School	*					*								
	Bitterroot						*								
	Johnson Lane						*								
	Mountain View Blvd.						*								
	1200 Minn Ave.						*								
	5th & 28th						*								
	27th & 10th Ave. S.						*								
	East Conoco						*								
	Two Moon Park						*								
	Newman School						*								
	Klenck Lane						*								
	Exxon						*								
	Johnson & Lockwood						*								
	Johnson Rd. N.						*								
	Woodland						*								
	Coburn Road						*								
	Central Park #1 E	*	*	*	*	*		*	*	*	*	*			*
	Fairgrounds										*	*			
	*Taft School	*						*							*
Bozeman	Traphagen Hall	*		*	*										
	*E. Main	*													
	*MSU Family Housing	*													
Butte	Greeley School	*		*	*	*									
	**Richter Residence	*		*	*										
	**Alpine West (2)												*		
	Hebgen Park #1		*			*									
	**Hebgen Park #2	*	*	*	*	*		*	*		*	*			*
	*Walkerville	*													
	Dr. Canty	*		*	*	*									
	**Floral Park	*	*	*	*	*									
Cascade County	ACM North						*								
	Treasurelite Plant						*								
	Stock Car Track						*								
	ACM East #1						*								
	Montana Power Substa						*								
	Phillips Refiner E						*								
	Phillips Ref. N #2						*								
	West Hill						*							*	
	Conoco E						*							*	
	Airport Industrial						*							*	
	Ft. Shaw						*								
	Cascade Fire Hall						*								
	Belt NE						*								
	Vaughan						*								
	Ulm						*								
	Stockett						*								
	Sun River						*							*	
	Conoco W													*	
Columbia Falls	Anders Residence	*		*	*										
Daniels County	Scobey Border #1	*	*	*	*			*	*						*
	Richardson	*		*	*										*
	**Engberg	*		*	*										
	Hanrahan	*		*	*										
Dawson County	Lindsay/Weilgosh	*													
Deer Lodge County	**Highway Junction	*		*	*	*		*							*
	**Mill Creek RR							*							
	**C-Hill							*							*
	*Warm Springs	*													

*New sites in 1980
**Discontinued Site in 1980

Table I, continued

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Flathead County	Dehlboms Mt. Box												*		
	Feirstein												*		
	RE Owen												*		
	Badrock Substa												*		
	Anaconda S												*		
	Teakettle Mtn. #1												*		
	Teakettle Mtn. #8												*		
	Aluminum City												*		
	NAAC Trailer	*					*						*		
	Polebridge	*	*												
	Bigfork	*		*	*										*
	**Water Supply														*
	Airport	*	*	*	*										*
	**Polebridge Met														*
	**Moose City	*													
	Big Prairie Met														*
	Glacier Park (15 sites)												*		
Glendive	*Dawson Co. Comm. College	*													
Granite County	**Phillipsburg/McKinley	*													
Great Falls	Hospital (CCHD)	*					*							*	
	Fire Station #1	*					*							*	
	** 10th Avenue South											*			
	Kiwanis Park	*	*	*	*	*		*	*						
	Park Drive						*								
	Super America						*								
	Mountain States						*							*	
	Central W						*							*	
	J & J Cafe						*								
	Holiday Inn						*								
	K Mart						*								
	15th St. Bridge						*								
	Holiday Village						*								
	*Riverview	*		*	*										
	*Black Eagle	*													
	*Lincoln School	*													
	*GF Federal											*			
	*Downtown	*													
Havre	Central City Bldg.	*													
Helena	Cogswell Bldg.	*													
	**East Stack Station	*		*	*	*	*	*							
	**Microwave	*		*	*	*	*	*							
	**Broudy Ranch						*	*							
	*Valley Bank	*													
	*Capital Courts	*													
Kalispell	**Strom	*		*	*										
	Universal Athletic	*		*	*										
	*Evergreen	*													
Lake County	Polson	*	*	*	*										
	**Ronan	*		*	*										*
	*Ronan Ninepipes	*	*												*
Laurel	Junior High	*					*								
	1 Mi. NE Coop						*								
	3/4 Mi. W. Coop						*								
	1/2 Mi. S Coop						*								
	St. John Church						*								
	E. of Laurel						*								
	Farm E. of Cenex						*	*							
	West Coop						*								*
	*New Farm	*						*							
Lewis & Clark Co.	Hastie	*		*	*	*	*								*
	Schneider Residence						*								
	A & W	*		*	*	*	*	*							*
Lewistown	*Downtown	X													

* New Site in 1980
**Discontinued in 1980

Table I, continued

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Libby	Brown Residence	*		*	*										
McCone County	**Ft. Peck	*													*
Miles City	*PCA Bldg.	*													
Missoula County	Malfunction Junction											*			
	Courthouse Roof	*	*	*	*	*									
	**Bonner 1	*													*
	Hoerner-Waldorf #1	*													
	Hoerner-Waldorf #2	*													
	**Hoerner-Waldorf #3	*													
	**Lions Park #1	*	*	*	*	*			*	*	*	*			*
	Rose Park	*							*			*			*
	McLeod Park	*	*												
	Schilling Street	*													
	**Olofson (Met)														*
	**Steigler (Met)														*
	**U of M (met)														*
Powell County	Grant-Kohrs (5 sites)						*								
	*Smith Ranch	*													
Rosebud County	**Fisher Butte	*													
	**Colstrip BN	*													
	**Colstrip McRae	*													
Silver Bow County	Tierney Residence	*		*	*										
	Ramsay W.												*		
	Ramway N.												*		
	Stauffer ESE												*		
	South Stauffer												*		
	South of Pond												*		
	Ramsay Power Station												*		
	Stauffer W.												*		

*New site in 1980
**Discontinued in 1980

KEY

TSP - Total Suspended Particulates
RP - Respirable Particulate
S Rate - Sulfation Rate
SO_2 - Sulfur Dioxide
NO_2 - Nitrogen Dioxide
THC - Total Hydrocarbons
O_3 - Ozone
CO - Carbon Monoxide
F - Fluoride
Dustfall - Total Dustfall
Met - Various meteorological parameters

Table II

LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID	Code	AQCR	County	City	Wd	AR	Neph.	Pyh.M.	Pyr.M.	B.P.	Temp.	D.P.	Long./Lat.or UTM*	Date of Oper.
Central Park	0080 059	F01	140	Yellowstone	Billings	X				X	X	X	X	1083219 - 454651	8-78 - 5-80
Billings Vo-Tech	0080 302	F02	140	Yellowstone	Billings		X								6-78 - 12-80
Farm E. of CENEX	0840 009	F01	140	Yellowstone	Laurel	X								1084435 - 453939	1-77 - 7-80
Laurel (New Farm)	0840 014	F02	140	Yellowstone	Laurel	X								1084425 - 454007	10-80 - 12-80
Taft School	0080 062	F01	140	Yellowstone	Billings	X				X	X	X	X	1082938 - 454637	8-80 - 12-80
Lockwood School	0080 006	F05	140	Yellowstone	Billings	X								1082630 - 454757	8-79 - 5-80
Fairgrounds	0080 061	F02	140	Yellowstone	Billings	X								1082845 - 454755	9-80 - 12-80
Kiwanis Park	0660 016	F01	141	Cascade	Great Falls	X								1111632 - 473035	1-80 - 2-80
Lincoln School	0020 007	F07	142	Deer Lodge	Anaconda	X				X	X	X	X	1125634 - 460731	7-78 - 11-80
Hiway Jct.	0040 004	F02	142	Deer Lodge	Anaconda	X	X							1125317 - 460809	10-77 - 8-79
County Airport	0400 704	J02	142	Deer Lodge	Anaconda	X								*5111.5 - 356.5	2-79 - 5-79
No. 2 Discharge Pond	0400 708	J02	142	Deer Lodge	Anaconda	X								*5113.5 - 362.0	1-79 - 5-79
Weather Hill	0400 707	J02	142	Deer Lodge	Anaconda	X								*5110.7 - 354.1	1-79 - 5-79
Mill Creek	0400 706	J02	142	Deer Lodge	Anaconda	X								*5107.0 - 354.5	1-79 - 2-79
Alpine West	0160 015	F02	142	Silver Bow	Butte	X								1123032 - 450045	8-79 - 6-78
Hebgen Park	0160 017	F01	142	Silver Bow	Butte	X		X						1123129 - 460013	6-78 - 12-80
Microwave	0760 903	F02	142	Jefferson	E. Helena	X								1115501 - 463244	1-78 - 3-79
A & W	0860 008	F02	142	Lewis & Clark	E. Helena	X								1115425 - 454637	2-80 - 6-80
Randall Ranch	1240 009	F03	143	Powder River	Broadus	X									9-77 - 8-78
Fort Peck	0980 001	F03	143	McCone	Ft. Peck	X								1062959 - 475948	9-77 - 5-79
Fisher Butte	1360 003	F03	143	Rosebud	Lame Deer	X								1063914 - 453734	
ST Site	1360 027	F02	143	Rosebud	Colstrip	X								1063443 - 455130	8-78 - 12-78
Scobey #1 (Border)	0340 001	F03	143	Daniels	Scobey	X	X	X	X	X	X	X	X	1052400 - 485930	3-77 - 12-80
Scobey #2 (Richardson)	0340 002	F03	143	Daniels	Scobey	X						X		1052513 - 484835	8-78 - 5-79
Scobey #4 (Hanrahan)	0340 004	F05	143	Daniels	Scobey	X								1141500 - 481838	11-80 - 12-80
Glendive Microw.	0360 001	F03	143	Dawson	Glendive	X								1140830 - 420200	9-77
Big Fork	0480 036	F05	144	Flathead	Big Fork	X								1140557 - 480400	11-79 - 12-80
Kalispell Airport	0480 304	F05	144	Flathead	Kalispell	X	X	X	X	X	X	X	X	1141500 - 481838	1-78 - 12-80
Water Supply	0480 302	F05	144	Flathead	Col. Falls	X				X		X		1140830 - 482000	10-76 - 6-78
Polebridge	0480 305	F05	144	Flathead	Polebridge	X						X		1141703 - 484709	9-78 - 11-78
Big Prairie	0480 308	F05	144	Flathead	Polebridge	X						X		1141841 - 484829	11-78 - 12-80
Ronan-Ninepipe	0820 012	F05	144	Lake	Ronan	X	X	X						1140759 - 472735	1-79 - 12-80
Polson	0820 304	F05	144	Lake	Polson	X				X		X		1140727 - 474120	10-78 - 5-79
Ronan	0820 011	F05	144	Lake	Ronan	X								1140546 - 473054	1-80 - 3-80
TV Mountain	1100 701	J05	144	Missoula	Missoula							X		1135200 - 470000	5-78 - 4-80
Lion's Park	1100 019	F01	144	Missoula	Missoula	X		X		X	X	X	X	1140025 - 465105	12-77 - 8-80
Stiegler	1100 703	505	144	Missoula	Missoula	X								1140814 - 465415	5-78 - 3-80
Olofson	1100 702	F05	144	Missoula	Missoula	X								1140424 - 464949	7-78 - 3-80
U of M	1100 704	F05	144	Missoula	Missoula	X								1135840 - 465150	5-78 - 3-80
Rose Park	1100 020	G01	144	Missoula	Missoula	X		X		X	X	X	X	1140014 - 465126	9-80 - 12-80
Hoerner-Waldorf #1	1100 015	G02	144	Missoula	Missoula	X								1141029 - 465700	12-77 - 2-80
Malfunction Jct. SE	1080 005	F01	144	Missoula	Missoula	X								*5192.5 - 727.5	4-80 - 5-80

Wd - Wind speed and direction
AR - Acoustic radar
Neph. - Nephelometer
Pyh.M - Pyrheliometer
Phy.M - Pyranometer
B.P. - Barometric Pressure
Temp. - Temperature
D.P. - Dew Point

A. ANACONDA

A. ANACONDA

The Anaconda study area includes monitoring sites in Deer Lodge, Powell and Granite Counties (Table A-I). The majority of air monitoring in this area and consequently the emphasis of this section is centered around the city of Anaconda.

Anaconda is situated at the southern end of the Deer Lodge Valley (Figure 1-A) at an altitude of 5,200 feet. With the mountainous Anaconda-Pintlar Wilderness to the south and west and the Flint Creek range to the north, the area is subject to temperature inversions about 40 percent of the year. Anaconda had a 1970 population of 9,771, which increased to 10,388 in 1980.

The main focus of attention for monitoring air pollutants in Anaconda has been emissions from the Anaconda Company copper smelter. In past years this smelter has emitted up to 200,000 tons per year of sulfur dioxide (SO_2). In addition to the SO_2 the smelter has emitted particulate matter containing heavy metals: lead, arsenic, and cadmium. On September 30, 1980, the Anaconda Company announced the closure of the 100 year-old smelter due to economic reasons. As a consequence, SO_2 has been virtually eliminated from the valley.

Table A-II summarizes sulfur dioxide concentrations for three sites in 1979 and 1980. The highest hourly reading of 4.21 ppm occurred at the Lincoln School site in the center of town. Readings at all three sites showed violations of the federal 3-hour standard of 0.5 ppm.

TABLE A-I

Anaconda Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Anaconda Lincoln School	Deer Lodge	State AQB	Population Oriented	Suburban Residential	Cedar Street, Anaconda
Hiway Junction	Deer Lodge	State AQB	Source Oriented	Rural-Agricultural	300' E of Lost Creek Hwy & 500' N of County Property
Warm Spring	Deer Lodge	State AQB	Source Oriented	Rural-Industrial	Warm Springs
*Mill Creek RR	Deer Lodge	State AQB	Source Oriented	Rural Industrial	SE of Anaconda at Mill Creek & RR Crossing
*C-Hill	Deer Lodge	State AQB	Source Oriented	Rural Industrial	Company owned property South of Anaconda/minimal data
*Philipsburg	Granite	State AQB	Background	Suburban Residential	McKinley Residence
Ovando-Smith	Powell	State AQB	Background	Rural-Agricultural	Five miles E. of Ovando

*Site discontinued in 1980

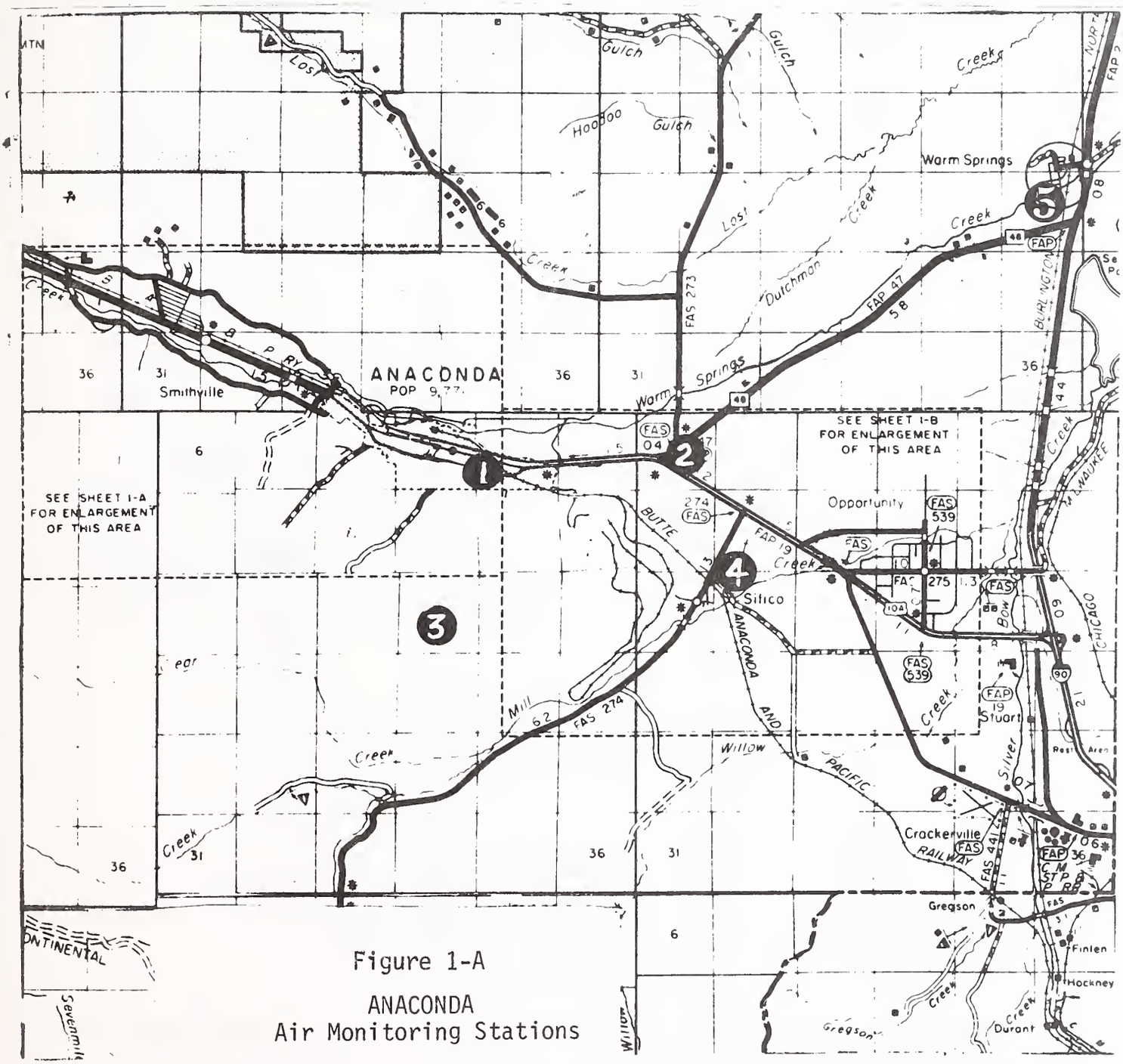


Figure 1-A

ANACONDA
Air Monitoring Stations

#	Site Name
1	Lincoln School
2	Hiway Junction
3	C-Hill
4	Mill Creek
5	Warm Springs

Table A-II
Anaconda Area Sulfur Dioxide
Parts Per Million

	Highway Junction - 1979		Mill Creek - 1979	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.96	.03	1.20	.03
Feb	2.30	.17	1.20	.02
Mar	1.80	.06	1.62	.03
Apr	.01	.00	.40	.00
May	1.20	.01	1.36	.07
Jun	1.87	.05	1.23	.05
Jul	.98	.03	.74	.02
Aug	.48	.03	2.00	.07
Sep				
Oct				
Nov				
Dec				
Annual Average:	.04		.03	

	Lincoln School -1979		Lincoln School - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.60	.03	1.00	.03
Feb	1.03	.05	.65	.04
Mar	.80	.03	.61	.02
Apr	.02	.00	1.72	.05
May	.93	.02	1.15	.08
Jun	.81	.01	1.51	.05
Jul	.93	.03	.00	.00
Aug	4.21	.07	.10	.01
Sep	.98	.04	.02	.01
Oct	.75	.04	.02	.01
Nov	.41	.03	.03	.02
Dec	.32	.01	.02	.00
Annual Average:	.03		.02	

Table A-III summarizes TSP values from sites in the Anaconda area as well as sites in Granite and Powell Counties. Although some high TSP readings were recorded, none violated the Federal 24-hour standard (260 ug/m^3) and the annual means were all well below the 75 ug/m^3 standard.

Table A-III
Anaconda Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Lincoln School	48	303	202	54	165	154
Hiway Jct.	38	86	81	32	93	83
Philipsburg-McKinley	39	97	95	--	--	--
Ovando-Smith	--	--	--	21	130	93
Warm Springs	--	--	--	32	158	90

Respirable particulate (RP) was monitored with a dichotomous sampler at the Lincoln School site. Table A-IV summarizes the RP results for 1979 and 1980. The state's use of dichotomous samplers (the largest current use in this country) is rather innovative. Because of its newness there are no federal standards of regulation. The dichotomous sampler splits RP (15 microns and smaller) into coarse (2.5 to 15 microns) and fine (less than 2.5 micron) fractions. Use of this sampler was an attempt by the Montana Air Pollution Study to discover the health effects of air pollution in Montana.

Table A-IV
Anaconda Area - Respirable Particulate
Micrograms per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
Lincoln School	79	41.1	19.6(11)	61.3	23.7(11)	89.6	36.1(11)
	80	37.8	12.9(7)	123.6	19.5(7)	133.2	32.7(7)

( ) - Parentheses denotes number of sample months

Nitrogen dioxide (NO_2) and Total Hydrocarbons (THC) were monitored for a short time at the Lincoln School site in 1979 but discontinued when readings did not seem significantly high. Table A-V summarizes the results of NO_2 and THC at this site.

Table A-V
Anaconda Area - NO_2 and THC
Parts Per Million

	Lincoln School - NO_2 - 1979		Lincoln School - THC - 1979	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.045	.017	3.2	1.5
Feb	.041	.009		
Mar	.018	.005		
Apr	.035	.004		
May	.018	.004		
Jun	.020	.003	2.5	1.7
Jul	.023	.003	3.0	1.5
Aug				
Sep			3.0	1.9
Oct			3.7	2.0
Nov			3.6	2.3
Dec				
Annual Average:	.007		1.8	

Ozone was also monitored at the Lincoln School site. Low ozone levels (two-year average of .029 ppm and maximum one-hour of .082) generated little concern. Table A-VI provides a summary of ozone readings taken at the Lincoln School site in 1979 and 1980.

Table A-VI
Anaconda Area - Ozone
Parts Per Million

	Lincoln School - 1979		Lincoln School - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.043	.023	.039	.023
Feb	.048	.035	.049	.028
Mar	.060	.036	.049	.029
Apr	.056	.037	.023	.015
May	.062	.038		
Jun	.060	.035		
Jul	.070	.038		
Aug	.082	.032		
Sep	.051	.029		
Oct	.040	.023		
Nov	.050	.026		
Dec	.048	.028		
Annual Average:	.032		.026	

Trace heavy metals such as lead, cadmium and arsenic are analyzed by atomic absorption from hi-volume filters. Sulfates and nitrates, also analyzed from hi-volume filters, use colorimetric methods. Table A-VII gives a summary of analyses done on hi-vol filters from the Lincoln School and Hiway Junction sites. Lead, arsenic and cadmium are of particular interest because of their high toxicity.

Table A-VII
Anaconda Area - Metals, Nitrate, Sulfate
Micrograms per Cubic Meter

		1979			1980		
Site		Mean	1-High	2-High	Mean	1-High	2-High
Lincoln School	As	.094	.795	.466(12)	.106	.876	.249(4)
	Cd	.015	.130	.097(12)	.010	.028	.027(4)
	Pb	.32	3.03	1.20 (12)	.17	.77	.52 (12)
	NO_3	1.2	7.8	6.9 (12)	.09	2.7	2.6 (4)
	SO_4	5.0	20.0	15.8 (12)	6.5	13.9	13.5 (4)
Hiway Junction	As	0.141	0.626	0.563(9)	0.103	0.250	0.194 (4)
	Cd	0.018	0.122	0.059(9)	0.009	0.043	0.009 (4)
	Pb	0.31	1.71	1.18 (9)	0.11	0.36	0.35 (12)
	NO_3	0.9	4.0	2.7 (9)	0.8	3.2	2.4 (4)
	SO_4	6.8	12.6	12.1 (9)	9.3	14.1	13.2 (4)

( ) - parentheses denotes number of sample months

Wind in the area tends to be southwesterly much of the year. During the spring the wind is predominately from the northwest. These winds provide ventilation which keeps the inversion average lower than other areas in the western part of the state.

B. BILLINGS

B. BILLINGS

The Billings study area includes air monitoring sites in Yellowstone County. The area is located between the Northern Great Plains and the Rocky Mountains; consequently, it has climatic conditions common to both regions. The elevation for this area ranges from 3100 to 3400 feet above sea level. Billings and Laurel both receive about 14 inches of precipitation per year. Population growth has been substantial in the last ten years. This is primarily due to coal and oil development. Yellowstone County's population increased 23 percent from 87,367 in 1970 to 107,661 in 1980; Billings' increased 11 percent from 61,581 to 68,343 and Laurel's 23 percent, from 4,454 to 5,469.

Pollution sources include the following:

1) Three oil refineries (SO_2, particulate, hydrocarbons, NOx, SO_3)
2) Coal-fired power plant (SO_2, particulate, NOx)
3) Sugar beet refinery (SO_2, particulate, NOx)
4) Sulfur plant (SO_2, SO_3)
5) Wood-fired home heating devices (fine particulate, CO)
6) Automobiles (CO, NOx, re-entrained particulate)

Billings area monitoring sites are listed on Table B-I; Figure 1-B shows the locations of most of the sites on an area map.

Table B-II summarizes TSP values for Billings and Laurel area hi-vols. None of these sites violated the Federal annual TSP standard (75 ug/m^3), but four sites recorded readings in excess of the 260 ug/m^3 24-hour standard.

TABLE B-I

Billings Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Billings					
Lockwood	Yellowstone	State AQB	Special Studies	Suburban-Industrial	Hardin Road E of Billings Lockwood School Complex
KGHL	Yellowstone	Yellowstone County Air Pollution Control (YCAPC)	Population Oriented	Rural-Agricultural	KGHL Station 3 3/4 miles W of Billings on Highway 10
City Hall	Yellowstone	YCAPC	Population Oriented	Center City - Commercial	3rd Avenue N & 27th Street Downtown Billings
Grand Ave. School	Yellowstone	YCAPC	Population Oriented	Suburban-Commercial	Grand Avenue School adjacent to Montanas Business District
Bench School	Yellowstone	YCAPC	Source Oriented	Suburban - Residential	Bench School on Milton Road
*Central Park	Yellowstone	State AQB	Population Oriented	Center City - Residential	Central Park bounded by Central Cook, 10th & 9th Streets
Fairgrounds	Yellowstone	State AQB	Source Oriented	Suburban - Industrial	Fairgrounds Complex, 6th Ave. N and Exposition Drive
Laurel					
Jr. High School	Yellowstone	YCAPC	Source Oriented	Center City - Residential	Laurel Jr. High School on Colorado Avenue
Farm E of Cenex	Yellowstone	State AQB	Source Oriented	Rural - Industrial	3/8 mile NE of Refinery

*Site discontinued in 1980

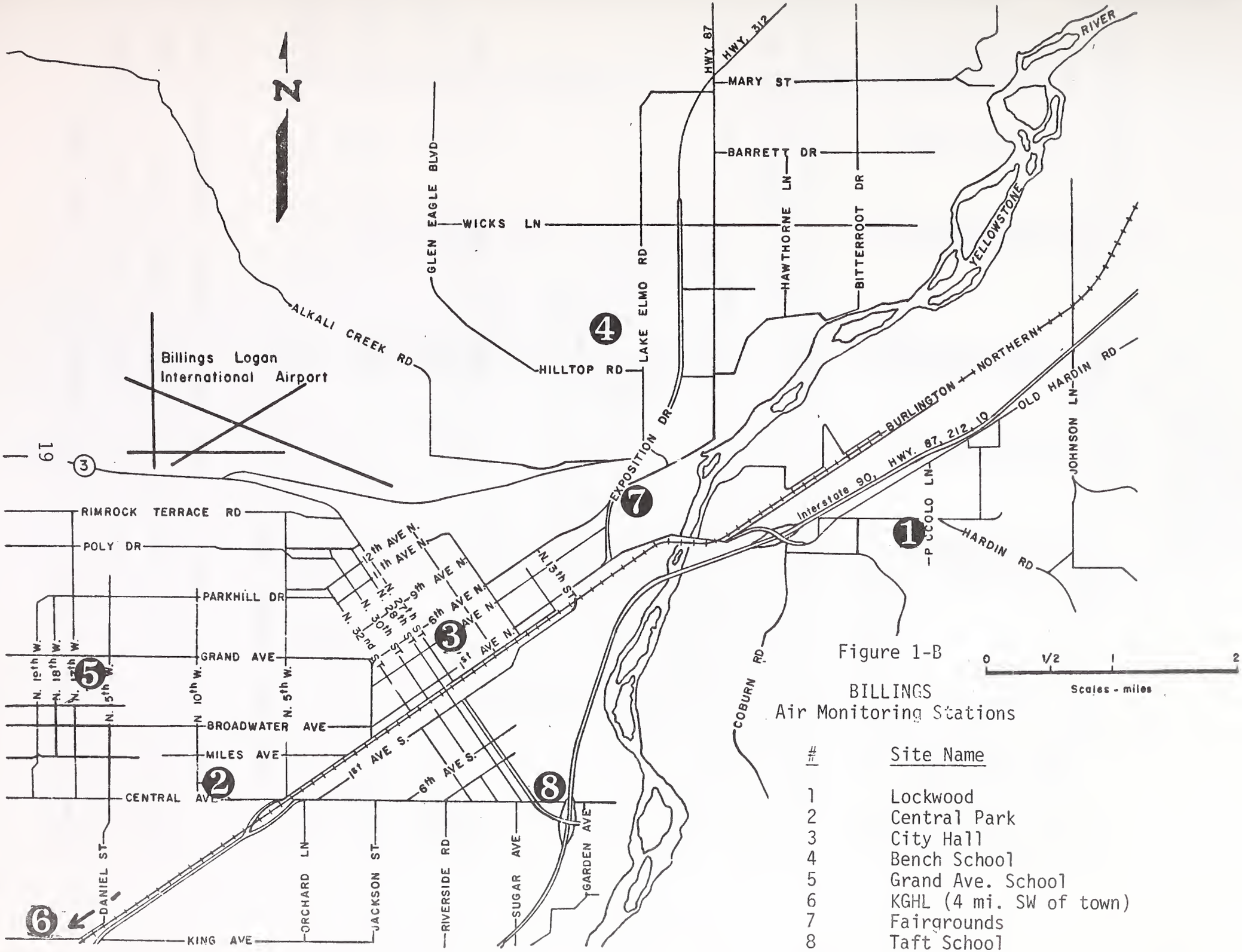


Figure 1-B

BILLINGS
Air Monitoring Stations

#	Site Name
1	Lockwood
2	Central Park
3	City Hall
4	Bench School
5	Grand Ave. School
6	KGHL (4 mi. SW of town)
7	Fairgrounds
8	Taft School

TABLE B-II

Billings Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Bench School	51	162	155	57	180	130
Central Park	72	266	246	*61	215	211
City Hall	70	288	155	74	166	150
Grand Avenue School	64	302	187	72	214	173
KGHL	42	130	100	48	133	128
Lockwood School	*65	353	258	*39	172	135
Taft School	--	--	--	*72	146	134
Laurel Jr. High	39	90	88	48	195	179

*Less than eight months data

Table B-III lists the mean annual and maximum 24-hour respirable particulate values for the Billings area. This sampling was done with dichotomous samplers, a new procedure which splits respirable particulate into coarse (2.5-15 micron) and fine (<2.5 micron) fractions.

Table B-III
Billings Area - Respirable Particulates
Micrograms Per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
Lockwood	79	70.6	20.7(6)	33.6	2.6(6)	79.6	23.3(6)
	80	30.8	12.7(2)	10.3	5.3(2)	41.1	19.0(2)
Central Park	79	55.4	17.2(11)	108.5	31.9(11)	131.6	49.1(11)
	80	31.2	14.9(4)	68.8	20.8(4)	95.7	35.8(4)
Taft School	80	38.2	16.5(4)	103.6	48.4(4)	141.9	64.9(4)

( ) - parentheses denotes number of sample months

Sulfur dioxide was analyzed at four locations in the Billings-Laurel area in 1979 and 1980. Table B-IV summarizes the maximum hourly reading for each month as well as the monthly and annual means. Two sites, Central Park and Lockwood School, were operated as part of the Montana Air Pollution Study (MAPS).

Table B-IV
Billings Area - Sulfur Dioxide
Parts Per Million

	Central Park - 1979		Central Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.110	.021	.375	.014
Feb	.225	.021	.141	.011
Mar	.055	.009	.102	.009
Apr	.110	.006	.094	.009
May	.065	.005	.053	.007
Jun	.040	.004		
Jul	.245	.010		
Aug	.068	.009		
Sep	.100	.014		
Oct				
Nov				
Dec	.055	.009		
Annual Average:	.011		.011	

	Lockwood - 1979		Lockwood - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.435	.025
Feb			.175	.015
Mar			.241	.015
Apr	.350	.011	.234	.018
May	.190	.008	.106	.013
Jun	.175	.009	.155	.045
Jul	.245	.019		
Aug	.195	.018		
Sep	.245	.025		
Oct	.227	.024		
Nov	.182	.023		
Dec	.268	.027		
Annual Average:	.018		.019	

Table B-IV (continued)
Billings Area - Sulfur Dioxide
Parts Per Million

	Billings - Taft School - 1980	
	Hourly Max	Monthly Mean
Jan		
Feb		
Mar		
Apr		
May		
Jun		
Jul		
Aug	.420	.030
Sep	.436	.014
Oct	.448	.015
Nov	.179	.009
Dec	.300	.018
Annual Average:	.015	

	Laurel Farm E. of Cenex-1979		Laurel Farm E. of Cenex-1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.74	.07	.415	.032
Feb	.32	.05	.322	.035
Mar			.295	.022
Apr	.16	.01	.235	.015
May	.23	.01	.300	.013
Jun	.18	.02		
Jul	.25	.01		
Aug	.16	.01		
Sep	.05	.00		
Oct	.08	.01		
Nov	.16	.02		
Dec	.43	.05		
Annual Average:	.03		.024	

Additional pollutants were measured at the Central Park site as part of the MAPS project. These included ozone, nitrogen dioxide, and total hydrocarbons. Table B-V summarizes hourly maximums, monthly means, and annual averages for ozone. There were two hourly readings greater than the Montana standard of 0.10 ppm./ This constitutes one violation; the rule allows for one exemption.

Table B-V
Billings Area - Ozone
Parts Per Million

	Central Park - 1979		Central Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.045	.017	.042	.017
Feb	.065	.017	.042	.015
Mar	.040	.017	.043	.015
Apr	.078	.027	.045	.020
May	.094	.037	.045	.021
Jun	.105	.037		
Jul	.082	.035		
Aug	.093	.031		
Sep	.110	.021		
Oct	.060	.015		
Nov	.040	.015		
Dec	.053	.014		
Annual Average:	.024		.017	

Table B-VI provides summary information for nitrogen dioxide from the Central Park site. There were no violations of the standard. Total hydrocarbons were measured for only three months in 1979; the analyzer recorded an hourly high of 14.1 ppm.

Table B-VI
Billings Area - Nitrogen Dioxide
Parts Per Million

	Central Park - 1979		Central Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.064	.018
Feb	.095	.025	.087	.018
Mar			.031	.009
Apr	.060	.015	.048	.010
May			.038	.009
Jun				
Jul				
Aug	.110	.012		
Sep	.064	.017		
Oct	.076	.018		
Nov	.067	.018		
Dec	.147	.027		
Annual Average:	.019		.014	

Sulfation rate (Table B-VII) was analyzed at many sites in Yellowstone County; this is a rough indicator of the quantity of sulfur oxides in the air. The advantage of utilizing the sulfation rate method is that numerous samples can be analyzed economically. The readings are a useful tool in determining sulfur dioxide trends in certain areas.

TABLE B-VII
Billings Area - Sulfation Rate
Milligrams sulfur trioxide per 100 square centimeters per day*

	1979		1980	
Site	Max.	Annual Aver.	Max.	Annual Aver.
Bitterroot	.58	.35	.53	.35
Sacrifice Cliff	1.08	.73	---	---
Lockwood Schol	1.08	.73	1.06	.72
Johnson Lane	.95	.59	.82	.81
KGHL Station	.79	.45	.76	.38
City Hall	.58	.33	.54	.29
Bench School	.59	.29	.53	.53
Garden Avenue	.60	.32	.34	.24
CNR 33 & 2 Ave. N.	.49	.26	.43	.20
Mtn. View Blvd.	.48	.25	.41	.24
1200 Minn. Ave.	.95	.56	.95	.53
5th & S. 28th	.66	.39	.60	.55
Grand Ave. School	.63	.33	.53	.27
S. 27th & 10 Ave. Sl.	1.02	.56	.90	.52
East Conoco	1.06	.61	.82	.78
Two Moon Park	1.18	.69	1.09	.70
Newman School	.66	.36	.58	.33
Klenck Lane	1.08	.67	1.09	.68
Exxon	1.00	1.02	---	---
Piccolo & N. Ft. Rd.	1.52	1.02	1.41	1.14
Hi-Ball Trucking	1.4	1.27	1.25	.87
Johnson & lockwood	1.07	.76	1.54	1.01
Johnson Rd. N.	1.51	.99	---	---
Woodland	1.04	.71	.87	.68
Coburn Road	1.78	.84	1.33	.86
Laurel Jr. Hi.	.37	.14	.29	.09
1 Mi. NE Coop	1.09	.66	1.06	.53
3/4 Mi. W. of Coop	.71	.49	.78	.53
St. John's Church	.24	.16	.32	.19
1/2 Mi. S. of Cenex	.62	.40	.66	.44
E. of Laurel	1.43	.89	1.81	1.01
Laurel Farm E. Cenex	1.51	.99	2.19	1.12
West Coop	.56	.32	.58	.29

*Values in excess of 0.5 indicate possible trouble spots and warrent continued study

In addition to weighing hi-vol filters for TSP, filters from Lockwood School and Central Park were analyzed for arsenic, cadmium, lead, nitrate and sulfate. These analyses are tabulated in Table B-VIII. Higher lead values were recorded at Central Park than at Lockwood School. This is probably due to automobile traffic (lead in gasoline).

Table B-VIII
Billings Area - Metals, Nitrate, Sulfate
Micrograms Per Cubic Meter

		1979			1980		
Site		Mean	1-High	2-High	Mean	1-High	2-High
Lockwood School	As	.001	.012	.003(8)	.001	.007	.003(4)
	Cd	.002	.009	.007(8)	.002	.006	.005(4)
	Pb	.08	.15	.13 (8)	.07	.40	.11 (4)
	NO_3	1.6	3.5	3.2 (8)	1.5	4.2	4.0 (4)
	SO_4	8.9	15.7	14.2 (8)	8.0	14.4	13.5 (4)
Central Park	As	.002	.022	.017(12)	.001	.005	.003(4)
	Cd	.002	.009	.007(11)	.002	.007	.60 (4)
	Pb	.26	.95	.85 (12)	.20	.82	.60 (4)
	NO_3	2.1	7.3	6.9 (12)	1.8	4.6	4.6 (4)
	SO_4	6.9	18.3	15.2 (12)	6.7	13.0	12.6 (4)

( ) - parentheses denotes number of sample months.

The Billings downtown area was designated non-attainment for carbon monoxide (CO) due to high readings in the past (see Appendix C). These readings were taken at the 27th and Montana site but this site had to be moved due to building construction. A new site was established at the Billings Fairgrounds. CO was measured for only two months in 1979 and four in 1980. In 1979 an hourly high of 4.2 ppm was recorded; in 1980, the high was 11.1 ppm. The values are still high enough to create concern. This is especially true if Billings continues the rapid growth of the past decade.

Billings winds tend to be primarily west southwest through west northwest, blowing the hardest during the winter months. The rimrocks tend to shelter the city when winds come from other directions; this decreases the drainage effect and may create temperature inversions.

C. BUTTE

C. BUTTE

The Butte study area consists of several sites within Silver Bow County. Butte, at an elevation of 5,200 feet, is surrounded on three sides by the Continental Divide. The surrounding peaks make the area a prime candidate for temperature inversions. Due to Butte's high elevation, summers come late and falls arrive early. Precipitation for Silver Bow County ranges from 12 to 20 inches annually.

Butte-Silver Bow's population fluctuates greatly depending on operational changes in the mining industry. County population dropped dropped 10 percent from 41,981 in 1970 to 37,950 in 1980. Future decreases in population may be seen due to the closure of the nearby copper smelter in Anaconda, although most mining activities in Butte have remained in operation.

Major sources include:

1) Open pit copper mine (particulate)

2) Copper ore concentrator (particulate)

3) Elemental phosphorous plant (fluoride, particulate)

4) Tepee burner (fine particulate, CO)

5) Asphalt plants (particulate)

6) Automobiles (NOx, re-entrained particulate)

7) Wood stoves and fireplaces (fine particulate, CO)

Butte area sites are listed on Table C-I and are shown in Figure 1-C.

Table C-II summarizes TSP values for Butte area hi-vols. A portion of Butte was designated as a non-attainment area for TSP in 1978 (see Appendix C). Two sites (Greeley School and Hebgen Park) were in violation of the federal annual standard of 75 ug/m^3 in 1979, but dropped below the standard in 1980.

TABLE C-I

Butte Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Butte					
Greeley School	Silver Bow	State AQB	Population Oriented	Center City - Residential	Top of Greeley School Building on South Side
Hebgen Park	Silver Bow	State AQB	Population Oriented	Center City - Residential	Southeast side of Hebgen Prk.
Dr. Canty	Silver Bow	State AQB	Population Oriented	Suburban - Residential	Roof of 225 S. Clark
Floral Park	Silver Bow	State AQB	Population Oriented	Suburban - Residental	SW Corner of Banks & State and State Street in Yard of Fire Station
Alpine West	Silver Bow	State AQB	Population Oriented	Suburban - Residential	Continental Drive One block east of Pine and Stua
Blaine School	Silver Bow	State AQB	Population Oriented	Suburban - Commerical	N. Main Street in Walkerville
Ramsay					
Tierney Residence	Silver Bow	State AQB	Source Oriented	Rural - Industrial	SE Corner of Ramsey 8 mi NNW of Stauffer Chemical Company

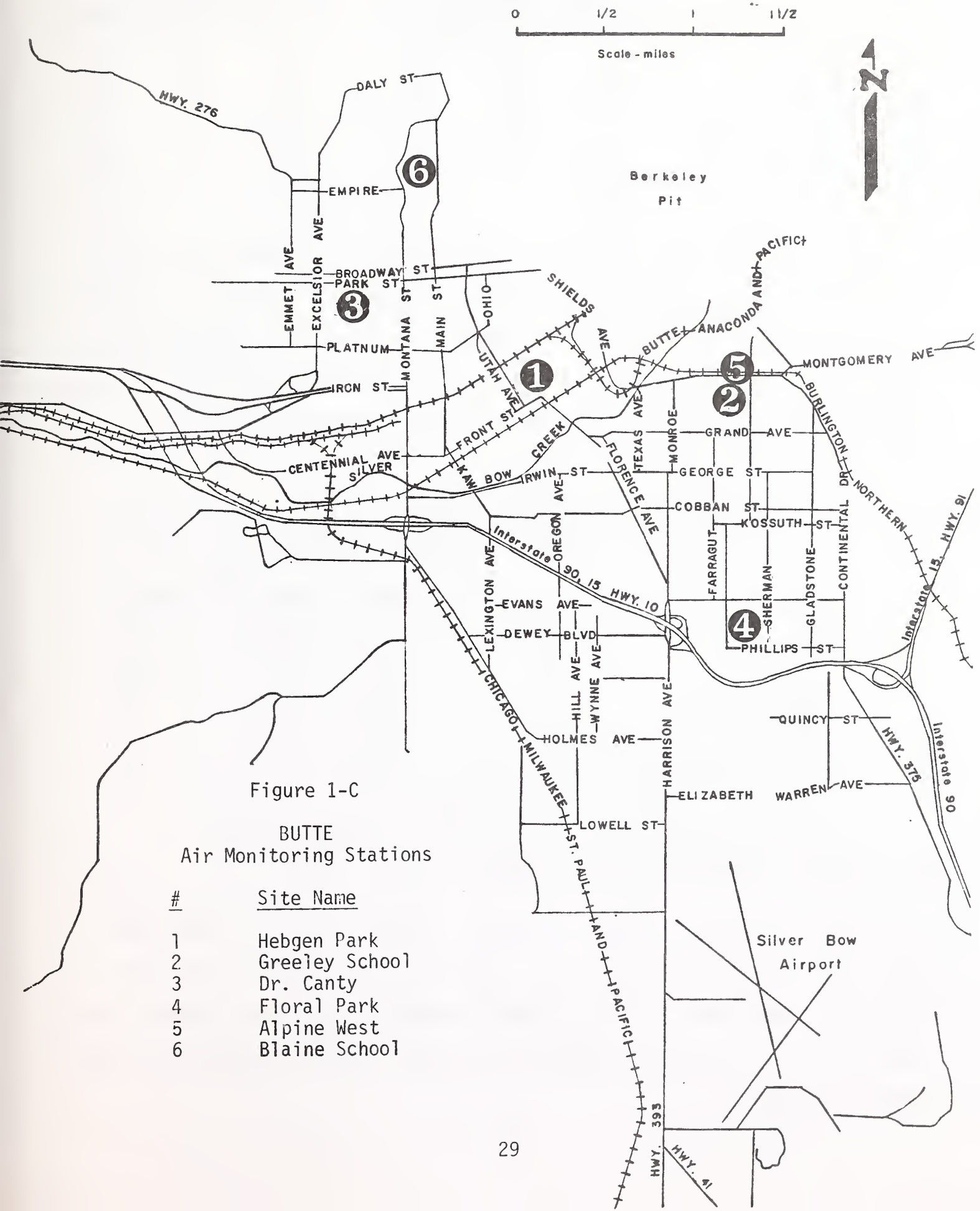


Figure 1-C

BUTTE
Air Monitoring Stations

#	Site Name
1	Hebgen Park
2	Greeley School
3	Dr. Canty
4	Floral Park
5	Alpine West
6	Blaine School

Table C-II
Butte Area - TSP
Micrograms Per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Dr. Canty Res.	61	216	197	66	322	192
Floral Park	51	117	112	64	172	166
Greeley School	80	242	214	72	220	209
Hebgen Park	77	306	304	74	252	224
Walkerville-Blaine School	--	--	--	*28	63	68
Ramsey - Tierney	36	84	83	33	90	89

*Less than eight months of data.

Table C-III summarizes fluoride concentrations in the Ramsay area, west of Butte, where Stauffer Chemical is located. Fluoride concentrations are determined from indicators called fluoride papers. The values are significantly higher than the guideline value of 0.30 ug/cm^2. High concentrations of fluoride can have devastating affects on both animals and vegetation.

Table C-III
Butte Area Fluorides
Micrograms Per Square Centimeter - 30 Days*

Site	1979 Max	1979 Mean	1980 Max	1980 Mean
Ramsay West	1.31	.89	.78	.56
Ramsay North	.36	.25	.26	.24
Stauffer ESE	3.80	2.27	1.11	.80
South Stauffer	1.62	.87	.64	.59
South of Pond	1.36	.86	.96	.58
Ramsay Power Station	2.82	1.41	1.59	1.31
Stauffer West	1.02	.83	.53	.32

*In 1979 the AQB used a guideline of 0.30 ug/cm^2 - 30 days to indicate possible trouble spots

In 1979, carbon monoxide was sampled at the Alpine West site and, for a short period, at the Hebgen Park site. Table C-IV lists hourly maximums and monthly means for the Alpine West site. Insufficient data was collected at the Hebgen Park site to warrant a summary. There were no violations of the carbon monoxide standards.

Table C-IV
Butte Area - Carbon Monoxide
Parts Per Million

Alpine West - 1979

	Hourly Max	Monthly Mean
Jan	16.0	3.1
Feb	12.0	1.3
Mar	6.7	.9
Apr	2.2	.5
May	2.5	.5
Jun	2.0	.4
Jul	7.0	.5
Aug	2.1	1.0
Annual Average:		1.0

Respirable particulate (Table C-V) was sampled at several sites as part of the MAPS program. RP readings are being correlated with respiratory ailment studies of school children in an attempt to ascertain the contribution of particulate levels to health problems in Montana. Respirable particulate are collected by dichotomous samplers. These samplers split the RP (15 microns and smaller) into coarse (2.5 to 15 microns) and fine (less than 2.5 microns) fractions.

Table C-V

Butte Area - Respirable Particulates
Micrograms Per Cubic Meter
Size Classifications - Microns

		<2.5		2.5-15		<15	
Site	Year	Max	Mean	Max	Mean	Max	Mean
Hebgen Park	79	56.1	17.9(8)	82.9	34.7(8)	112.3	52.6(8)
	80	69.5	21.6(8)	102.1	30.2(8)	140.4	49.4(8)
Floral Park	79	36.1	14.1(10)	78.1	21.7(10)	93.1	35.3(10)
	80	47.8	17.0(4)	74.1	18.5(4)	84.6	35.5(4)

( ) - parentheses denotes number of sample months

Nitrogen dioxide was monitored at the Hebgen Park site in 1979 and 1980; sulfur dioxide was measured for a few months in 1979. Table C-VI lists high hourly concentrations and monthly means for NO_2 at the Hebgen Park site.

Table C-VI
Butte Area - Nitrogen Dioxide
Parts Per Million

	Hebgen Park - 1979		Hebgen Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.200	.063	.125	.026
Feb	.187	.039	.105	.029
Mar			.047	.016
Apr			.054	.015
May			.045	.013
Jun			.049	.012
Jul			.033	.006
Aug				
Sep	.078	.081		
Oct	.056	.008		
Nov	.075	.016	.043	.023
Dec	.099	.019	.108	.023
Annual Average:	.030		.019	

Ozone was measured at the Hebgen Park site in 1979 and 1980. The data collected was found not to be significantly high; annual averages for the two years were 0.020 and 0.018 ppm. Table C-VII gives a summary of the ozone data.

Table C-VII
Butte Area - Ozone
Parts Per Million

	Hebgen Park - 1979		Hebgen Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.033	.005	.030	.008
Feb	.047	.017	.055	.011
Mar	.058	.023	.053	.023
Apr	.068	.034	.075	.030
May	.064	.033	.083	.039
Jun	.061	.031	.028	.011
Jul	.061	.029	.062	.029
Aug	.063	.029		
Sep	.047	.016		
Oct	.053	.013		
Nov	.031	.007		
Dec	.033	.010		
Annual Average:	.020		.018	

Lead, arsenic, cadmium, sulfates, and nitrates were analyzed from hi-volume filters. Table C-VIII lists this data for three sites in Butte. The concentrations of the heavy metals are somewhat high and can probably be attributed to the mining activity in the area. The values are considerably lower than those found in the smelter towns of Anaconda and East Helena.

Table C-VIII
Butte Area - Metals, Sulfates, Nitrates
Micrograms Per Cubic Meter

		1979			1980		
Site		Mean	1-High	2-High	Mean	1-High	2-High
Greeley School	As	0.018	0.076	0.055 (12)	.021	.065	.063 (4)
	Cd	0.007	0.030	0.026 (11)	.009	.033	.025 (4)
	Pb	0.26	0.83	0.60 (12)	.20	.58	.55 (4)
	NO_3	2.0	5.4	4.6 (12)	2.2	6.3	5.3 (4)
	SO_4	5.1	8.5	7.8 (12)	6.1	10.6	8.0 (4)
Hebgen Park	As	0.014	0.120	0.049 (11)	.017	.092	.044 (4)
	Cd	0.006	0.029	0.026 (11)	.010	.044	.037 (4)
	Pb	0.28	1.40	1.02 (11)	.26	.64	.57 (4)
	NO_3	2.5	8.6	7.8 (11)	2.2	6.8	6.1 (4)
	SO_4	5.2	12.0	9.8 (11)	5.9	17.0	10.2 (4)
Dr. Canty	As	0.018	0.128	0.103 (11)	.024	.117	.076 (4)
	Cd	0.007	0.044	0.027 (11)	.011	.071	.035 (4)
	Pb	0.29	1.11	0.78 (11)	.29	.83	.76 (4)
	NO_3	2.0	7.1	6.2 (12)	2.5	8.5	6.0 (4)
	SO_4	5.2	13.2	9.6 (12)	6.2	18.2	12.5 (4)
Floral Park	As	0.009	0.104	0.028 (10)	.012	.031	.030 (4)
	Cd	0.005	0.024	0.019 (10)	.012	.077	.049 (4)
	Pb	0.21	1.11	0.71 (10)	.18	.42	.39 (4)
	NO_3	1.6	6.9	5.2 (10)	2.1	5.8	4.7 (4)
	SO_4	4.5	15.2	8.0 (10)	6.9	17.9	16.6 (4)

( ) - Parentheses denotes number of sample months.

Visibility was measured with a nephelometer at Hebgen Park to gain supplemental particulate data for the MAPS study. The instrument measures scattering coefficient (amount of light lost through deflection by particulate matter) and as such is not a precise measurement of the distance one can clearly see, but merely an indication. If needed, the data user can request this information from the Air Quality Bureau.

Butte area winds tend to be light (6 mph or less) and circular in pattern, a factor which contributes significantly to the high incidence of temperature inversions.

D. EASTERN MONTANA

D. EASTERN MONTANA

Eastern Montana air monitoring sites are generally considered those sites east of Billings. The data collected at Scobey as part of the Poplar River Project is presented in a later chapter. Table D-I lists the eastern Montana sites; Figure 1-D shows site locations on a map of the eastern part of the state.

The sites are primarily used to collect background data; however, there are some source specific sites near coal mines in the southcentral portion of the state. The broad expanse of the area is primarily used for agricultural purposes and is sparsely populated. The elevations range from 2500 to 3500 feet. The climate tends to be harsh, with long cold winters and hot dry summers.

Pollution sources include:

1) Agriculture (particulate)
2) Coal development and mining (particulate)
3) Coal-fired power plants at Colstrip and Sidney (particulate, NOx, SO_2)
4) Gas sweetening plants (SO_2)
5) Oil well flares and vents (SO_2, H_2S)
6) Sugar beet refinery (particulates)

Table D-II summarizes TSP data for eastern Montana. The levels are generally quite low and do not approach the federal standards.

TABLE D-I

Eastern Montana Area
Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Fort Peck*	McCone	State AQB	Background	Rural-Agricultural	3 mi W of Ft Peck on Hwy 24
Lindsay Weilgosh	Dawson	State AQB	Background	Rural-Agricultural	Weilgosh Ranch NW of Lindsay
Lame Deer*	Rosebud	Tribal	Special Study	Rural-Agricultural	Northern Cheyenne Indian Reservation
Decker Thomas Ranch	Big Horn	State AQB	Background	Rural-Agricultural	5 mies NE of Decker on SW shore of Tongue River Reservoir
Hardin* Warren Ranch	Big Horn	State AQB	Background	Rural-Agricultural	Field at Warren Ranch
Colstrip BN	Rosebud	State AQB	Background	Rural-Agricultural	Saddle shaped hill 1/2 mile North of county line
McRae*	Rosebud	State AQB	Background	Rural-Agricultural	Hill east of Greenleaf Creek near corral
Fisher Butte*	Rosebud	State AQB	Background	Rural-near urban	East of Lame Deer near truckstop
Miles City PCA Building	Custer	State AQB	Background	City Center - Commercial	PCA Building
Glendive Dawson Comm. College	Dawson	State AQB	Background	Rural-Near urban	Roof of Administration Building

*Site discontinued in 1980

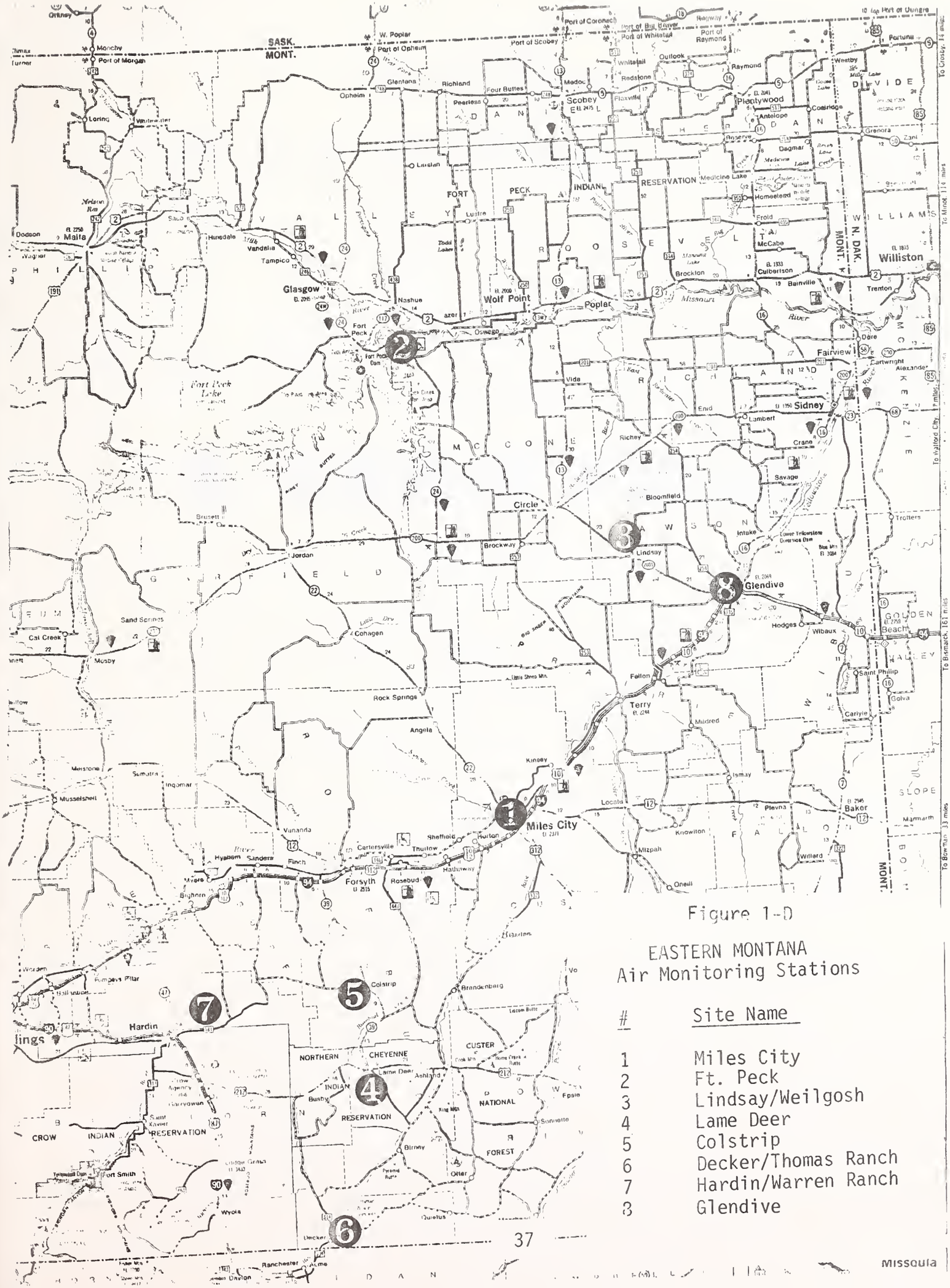

SASK.
MONT.
Malta
Glasgow
Wolf Point
Fort Peck
Fort Peck Lake
Poplar
Scobey
Plentywood
Williston
Sidney
Fairview
Circle
Brockway
Jordan
Lindsay
Glendive
Miles City
Forsyth
Hardin
Colstrip
Brandenberg
Sand Springs
Cat Creek
Mosby
Cohagen
Rock Springs
Angela
Kinsey
Terry
Fallon
Baker
Ismay
Locate
Plevna
Mildred
Carlyle
Golva
Saint Phillip
Wibaux
Hodges
Beach
Bloomfield
Savage
Crane
Lambert
Richey
Vida
Trenton
Culbertson
Brockton
Bainville
Frazer
Nashua
Oswego
Fort Peck Dam
Vandalia
Tampico
Hinsdale
Saco
Dodson
Whitewater
Loring
Opheim
Glentana
Richland
Four Buttes
Peerless
Port of Opheim
Port of Scobey
Port of Coronach
Port of Big Beaver
Port of Whitetail
Port of Raymond
Whitetail
Redstone
Flaxville
Medicine Lake
Homestead
Frazer
Outlook
Raymond
Westby
Portuna
Antelope
Coalridge
Grenora
Zahl
Dagmar
Frold
McCabe
Lustre
Lauslan
Port of Morgan
Monchy
Ottinsy
Turner
Timas
Circle
Brusett
Jordan
Brockway
Lindsay
Glendive
Intake
Lower Yellowstone Diversion Dam
Trotters
Hodges
Wibaux
Beach
Golden Valley
Saint Phillip
Golva
Carlyle
Mildred
Ismay
Locate
Plevna
Baker
Fallon
Terry
Knowlton
Mizpah
Willard
Marmarth
Slope
Bowman
Rock Springs
Angela
Kinsey
Musselshell
Melstone
Sumatra
Ingomar
Vananda
Hysham
Sanders
Finch
Custer
Sheffield
Horton
Thurlow
Hathaway
Rosebud
Forsyth
Myers
Bighorn
Pompeys Pillar
Hardin
Crow Agency
Garryowen
Saint Xavier
Crow Indian Reservation
Fort Smith
Northern Cheyenne Indian Reservation
Lame Deer
Ashland
Busby
Birney
Otter
Custer National Forest
Sonnette
Epsie
Quietus
Wyola
Decker
Ranchester
Dayton
Big Horn
Tongue River
Rosebud Creek
Little Sheep Mtn.
Missouri River
Fort Peck Lake
Big Sheep Mtn.
Little Dry Creek
Dry Creek
Big Dry Creek
Redwater River
Poplar River
Big Muddy Creek
Medicine Lake
Lake Creek
Lake Thompson
Lake Mary
Lake Alice
Lake Ilo
Lake Zahl
Lake Metigoshe
Lake Darling
Lake Upsilon
Lake Sakakawea
Lake Oahe
Lake Audubon
Lake Sakakawea
Lake Oahe
Lake Audubon
Lake Sakakawea
Lake Oahe
Lake Audub

Table D-II
Eastern Montana Area TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Warren Ranch	20	135	113	--	--	--
Colstrip - BN	*37	174	165	--	--	--
Thomas Ranch - Decker	38	134	133	39	139	98
Fisher Butte - Lame Deer	11	143	47	--	--	--
Ft. Peck	*20	153	100	--	--	--
Lindsay - Weilgosh	27	208	183	26	152	115
Glendive-Dawson College	--	--	--	*18	68	63
Miles City-PCA Bldg.	--	--	--	*55	158	148

*Less than eight months data

E. GREAT FALLS

E. GREAT FALLS

The Great Falls study area includes all sites in Cascade County. The county is located in a borderline area between the Rocky Mountains and the Northern Great Plains. As a consequence, it has climatic conditions common to both regions.

Great Falls is situated at the confluence of the Sun River with the Missouri River at an elevation of 3,300 feet. The city tends to be windy, with cold winters and hot summers. Temperature inversions are not normally a problem due to persistent winds.

Population counts decreased from 1970 to 1980 for both Cascade County and Great Falls. Cascade County decreased one percent from 81,804 to 80,639 while Great Falls decreased six percent from 60,091 to 56,105.

Table E-I lists monitoring sites for the Great Falls area. Figure 1-E locates sites on a map of Great Falls.

Air pollution sources include:

1) Two grain mills (fine particulate)

2) An oil refinery (hydrocarbon, SO_2)

3) A copper refinery* (particulates)

4) Automobiles (NOx, CO, lead)

5) Home heating devices (fine particulate, CO, HC)

*The copper refinery was shut down in September 1980 as part of the closure of the copper smelter in Anaconda.

TABLE E-I
Great Falls Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Great Falls					
Kiwanis Park	Cascade	State AQB	Population-oriented	Center city-residential	Park bounded by 25th, 23rd street and 5th and 6th avenue
CCHD (City-County Health Department)	Cascade	Cascade County APC	Source oriented	Suburban-residential	Roof of City-County Health Department - 1130 17th Avenue South
Fire Station #1	Cascade	CCAPC	Population-oriented	Center city-residential	9th Street and First Avenue South
10th Ave. South	Cascade	CCAPC	Population-oriented	Center city-residential	Corner 9th St. South and 10th Ave. South
(New sites in 1980)					
Riverview	Cascade	CCAPC	Population-oriented	Suburban-residentual	Riverview School - 100 Smelter Avenue
Black Eagle	Cascade	CCAPC	Population-oriented	Center city - commercial	Roof of Black Eagle Post Office
Lincoln School	Cascade	CCAPC	Population-oriented	Suburban - commercial	625 27th Street
GF Federal	Cascade	CCAPC	Source oriented	Suburban - commerical	Back of GF Federal Parking Lot-10th Ave. So.
Downtown	Cascade	CCAPC	Source oriented	Center city - commerical	Roof of City Library 301 2nd Avenue North

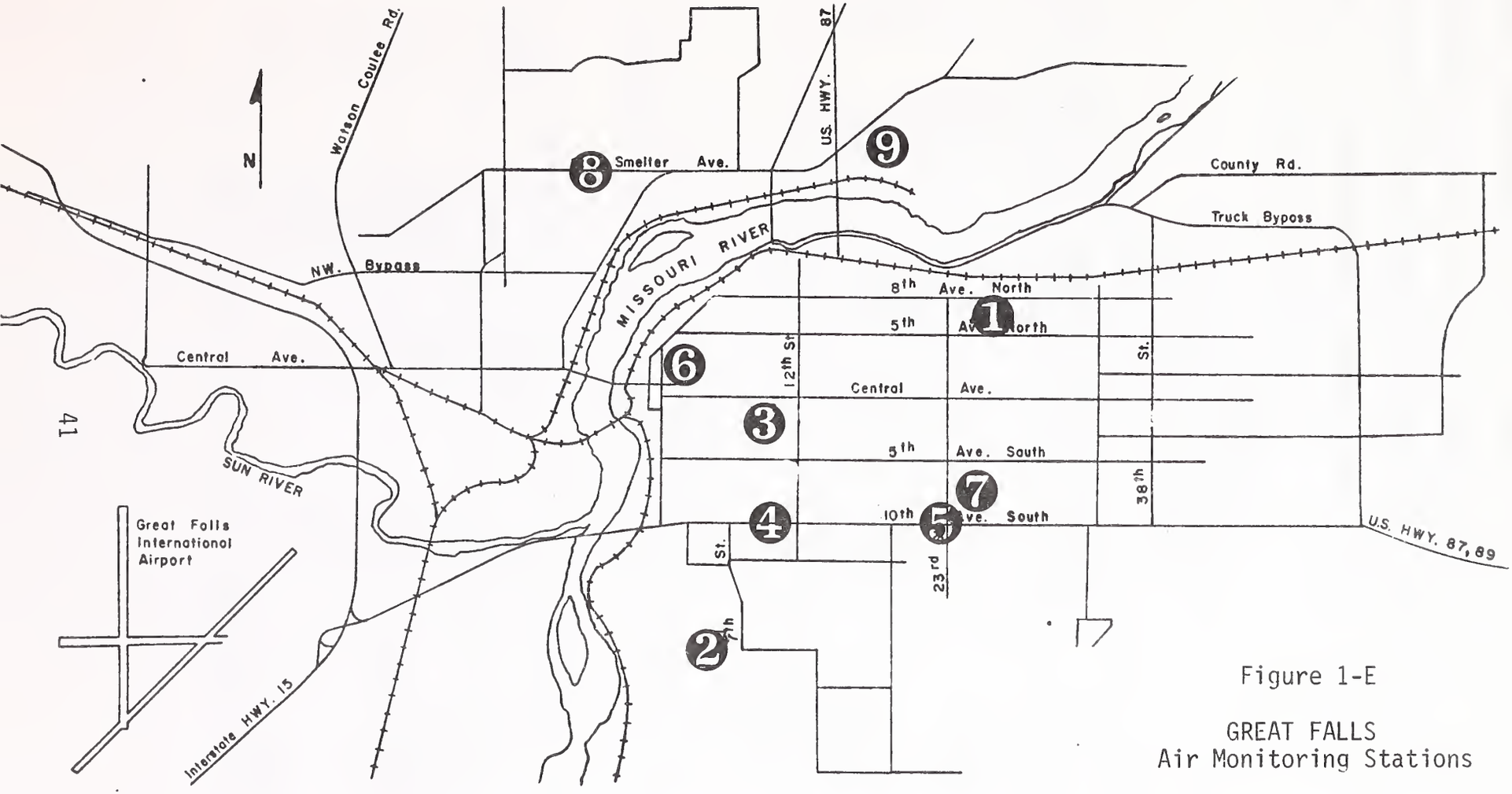


Figure 1-E

GREAT FALLS
Air Monitoring Stations

#	Site Name	#	Site Name
1	Kiwanis Park	6	Downtown
2	CCHD	7	Lincoln Sch.
3	Fire Station #1	8	Riverview
4	10th Ave. S.	9	Black Eagle
5	Gt. Falls Federal		

Table E-II provides a summary of TSP data for Great Falls. No sites were in violation of the federal standards. The Fire Station site had the highest annual average of 71 ug/m^3 in 1979 and 72 in 1980. The Cascade County Health Department installed several new sites in 1980 as a result of network review. These sites do not provide a complete year of data collection; data interpretation is inconclusive. Dustfall measurements at seven sites are listed on Table E-III.

TABLE E-II

Great Falls Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
GF - Black Eagle	--	--	--	*62	178	148
GF - Fire Station	71	189	188	72	194	191
GF - Downtown	--	--	--	*57	138	127
GF - CCHD	44	145	144	37	198	106
Kiwanis Park	43	111	105	*36	103	92
GF - Lincoln School	--	--	--	*46	97	96
GF - Riverview	--	--	--	*58	199	135

*Less than eight months of data

TABLE E-III

Great Falls Area - Dustfall
Tons per Square Mile

Site	1979 Max.	1979 Annual Aver.	1980 Max.	1980 Annual Aver.
Airport Industrial	12.72	4.46	15.25	3.70
Mountain States	26.59	12.50	48.08	19.65
Cascade Co. Health Dept.	6.71	3.35	4.83	2.41
Fire Station #1	37.20	10.57	23.93	9.03
West Hill	34.73	10.91	37.57	7.06
Sun River	5.60	3.75	10.27	3.73
KOA Campground	--	--	12.15	4.58

Montana Standard = 10 g/m^2 - 30 day average (28.5 Ton/Sq. mile)

Carbon monoxide was measured at two sites along 10th Avenue South in Great Falls. In 1979 the sampling was done at 10th Avenue South and 9th Street. This site was used to designate the area non-attainment (see Appendix C). Due to a leasing problem, the site had to be relocated a short distance away on 10th Avenue South at the Great Falls Federal site. Table E-IV lists the high concentrations and means for both sites.

Table E-IV
Great Falls Area - Carbon Monoxide
Parts Per Million

	10th Avenue So. - 1979		Great Falls Federal - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	15.8	3.5		
Feb	14.2	1.9		
Mar	9.7	2.5		
Apr	9.7	2.2		
May	9.0	4.3	2.6	.5
Jun			2.5	.4
Jul			2.5	.4
Aug			3.7	.7
Sep			10.4	1.0
Oct			5.0	1.2
Nov			8.2	1.4
Dec			13.3	1.4
Annual Average:	2.9		.8	

Respirable particulate (Table E-V) was sampled at Kiwanis Park as part of the MAPS study. RP are measured by using a dichotomous sampler. These samplers split the RP (less than 15 microns) into two fractions: coarse (2.5-15 microns) and fine (less than 2.5 microns). RP levels at this site are some of the lowest in the state.

Table E-V
Great Falls Area - Respirable Particulates
Micrograms per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
G.F.-Kiwanis Park	79	31.4	7.8(12)	43.5	15.5(12)	60.7	23.0(12)
	80	25.6	9.0(5)	64.8	15.9(5)	76.8	25.2(5)

( ) - parentheses denote number of sample months

Sulfur dioxide and nitrogen dioxide levels were monitored at the Kiwanis Park site in 1979 and 1980 as part of the MAPS project. Concentrations of these pollutants were found to be quite low. Tables E-VI and E-VII provide a summary of high concentrations, monthly means, and annual averages for the above mentioned pollutants.

Table E-VI
Great Falls Area - Sulfur Dioxide
Parts Per Million

	Kiwanis Park - 1979		Kiwanis Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.012	.002
Feb			.016	.001
Mar			.026	.002
Apr	.015	.001		
May	.030	.001		
Jun	.070	.001		
Jul	.020	.000		
Aug	.020	.000		
Sep	.005	.000		
Oct	.005	.000		
Nov	.004	.000		
Dec	.003	.001		
Annual Average:	.0004		.002	

Table E-VII
Great Falls Area - Nitrogen Dioxide
Parts Per Million

	Kiwanis Park - 1979		Kiwanis Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.035	.008
Feb			.049	.012
Mar			.040	.009
Apr	.045	.009		
May	.048	.008		
Jun	.053	.009		
Jul	.047	.007		
Aug	.038	.008		
Sep	.043	.009		
Oct	.059	.012		
Nov	.030	.009		
Dec	.033	.008		
Annual Average:	.009		.010	

Sulfation rate (Table E-VIII, following page) was monitored extensively in Cascade County. The readings for the past few years have shown consistently low concentrations except for those sites very close to the oil refinery. The City-County Health Department has discontinued this sampling as of January, 1981.

Heavy metals, sulfates and nitrates were analyzed from hi-volume filters from Kiwanis Park. The readings appear quite low. Table E-IX lists a summary of this data.

Table E-IX
Great Falls Area - Metals, Sulfates, Nitrates
Microgram Per Cubic Meter

		1979			1980		
Site		Mean	1-High	2-High	Mean	1-High	2-High
G. F. Kiwanis Park	As	0.002	0.012	0.012 (12)	.002	.009	.007 (4)
	Cd	0.002	0.012	0.009 (12)	.001	.005	.004 (4)
	Pb	0.21	0.93	0.80 (10)	.10	.24	.23 (4)
	NO_3	1.2	4.1	3.7 (11)	1.1	5.4	3.5 (4)
	SO_4	3.7	11.5	10.5 (11)	3.6	6.7	6.3 (4)

Table E-VIII

Great Falls Area - Sulfation Rate
Milligrams Sulfur Trioxide Per 100 Square Centimeters Per Day

Site	1979 Max.	1979 Annual Aver.	1980 Max.	1980 Annual Aver.
ACM North	.155	.021	.251	.058
Treasurelite	.019	.002	.041	.006
Stockcar Track	.617	.164	.564	.158
ACM East #1	.209	.060	.145	.051
Mt. Power Substa.	.076	.012	.348	.068
Phillips Ref. E	1.20	.274	1.063	.307
Phillips Ref. N#1	.617	.186	.624	.090
Phillips Ref. S.	.029	.007	.140	.044
Phillips Ref. #2	.547	.111	.970	.229
West Hill	.003	.001	.048	.009
Airport Industrial	.002	.001	.037	.008
Fort Shaw	.005	.001	.034	.004
Cascade Fire Hall	.020	.002	.069	.014
Belt	.001	.000	.037	.009
Vaughan	.001	.001	.016	.002
Ulm	.034	.004	.043	.005
Stockett	.047	.006	.047	.008
Sun River	.005	.001	.032	.007
Super America	.069	.013	.066	.022
Mountain States	.51	.146	.195	.040
Central West	.188	.037	.270	.049
J & J Cafe	.244	.070	.296	.135
Casc. Co. Hlth. Dept.	.064	.006	.041	.004
Fire Station #1	.026	.003	.091	.017
K-Mart	.230	.063	.270	.074
15th St. Br. N.	.525	.110	.469	.132
15th St. Br. S.	.165	.044	.469	.127
Holiday Village	.054	.022	.087	.023
Park Drive	.116	.035	.099	.029
Holiday Inn	.120	.037	.135	.053
10th Ave. So.	.069	.013	---	---

AQB used an indicator of .5 milligram SO_3/100 sq cm/day - one month maximum to signal possible problem areas.

F. HELENA
EAST HELENA

F. HELENA-EAST HELENA

The Helena-East Helena study area includes monitoring activities in Lewis and Clark and Jefferson Counties. Helena and East Helena are located at the southern end of the Helena Valley. The valley, approximately 40 miles in width and 4100-4300 feet in elevation, is bordered by mountain ranges on all sides. The cities of Helena and East Helena, like other cities in mountainous areas, are subject to frequent temperature inversions in winter months.

The area population rose 29 percent from 1970 to 1980 (Lewis and Clark County up 29 percent, 33,281 to 43,053; Helena up five percent, 22,730 to 23,818; East Helena down 0.5 percent, 1,651 to 1,643).

The area's monitoring sites are located on Figure 1-E and listed on Table F-I.

Pollution sources in the area include:

1) Primary lead smelter (lead, particulate, SO_2)

2) Copper oxide, zinc oxide manufacturer (Heavy metals, particulates)

3) Automobiles (NOx, CO, lead, re-entrained particulate)

4) Woodstoves and fireplaces (fine particulate, CO, organic HC)

Table F-II provides a summary of TSP data for Helena and East Helena. The only site showing TSP problems is the East Helena - Hastie site. This site is located directly north of the ASARCO lead smelther. It showed an annual average of 79 ug/m^3 in 1979 and increased to 86 in 1980.

TABLE F-I

Helena-East Helena Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Helena					
Cogswell Building	Lewis & Clark	State AQB	Population Oriented	Center city - Residential	Poof of Cogswell Building, Lockey & Sanders Streets
*Valley Bank	Lewis & Clark	L&C Health	Special Study	Center city - Industrial	Roof of Valley Bank on North Montana
*Capital Courts	Lewis & Clark	L&C Health	Special Study	Center city - Residential	Roof of Capital Courts on Dearborne Avenue
East Helena					
Hastie	Lewis & Clark	State AQB	Source Oriented	Center city - Residential	212 E. Pacific Street
A & W	Lewis & Clark	State AQB	Source Oriented	Suburban - Residential	Edge of Town, S of Hiway 12 Next to A & W
East Stack** Station	Lewis & Clark	State AQB	Source Oriented	Rural - Agricultural	1 1/2 mi E of ASARCO Smelter
Microwave	Jefferson	State AQB	Source Oriented	Rural - Agricultural	2 mi S of ASARCO
Broudy Ranch**	Jefferson	State AQB	Source Oriented	Rural - Agricultural	4 mi SE of ASARCO

* New sites in 1980
**Discontinued in 1980

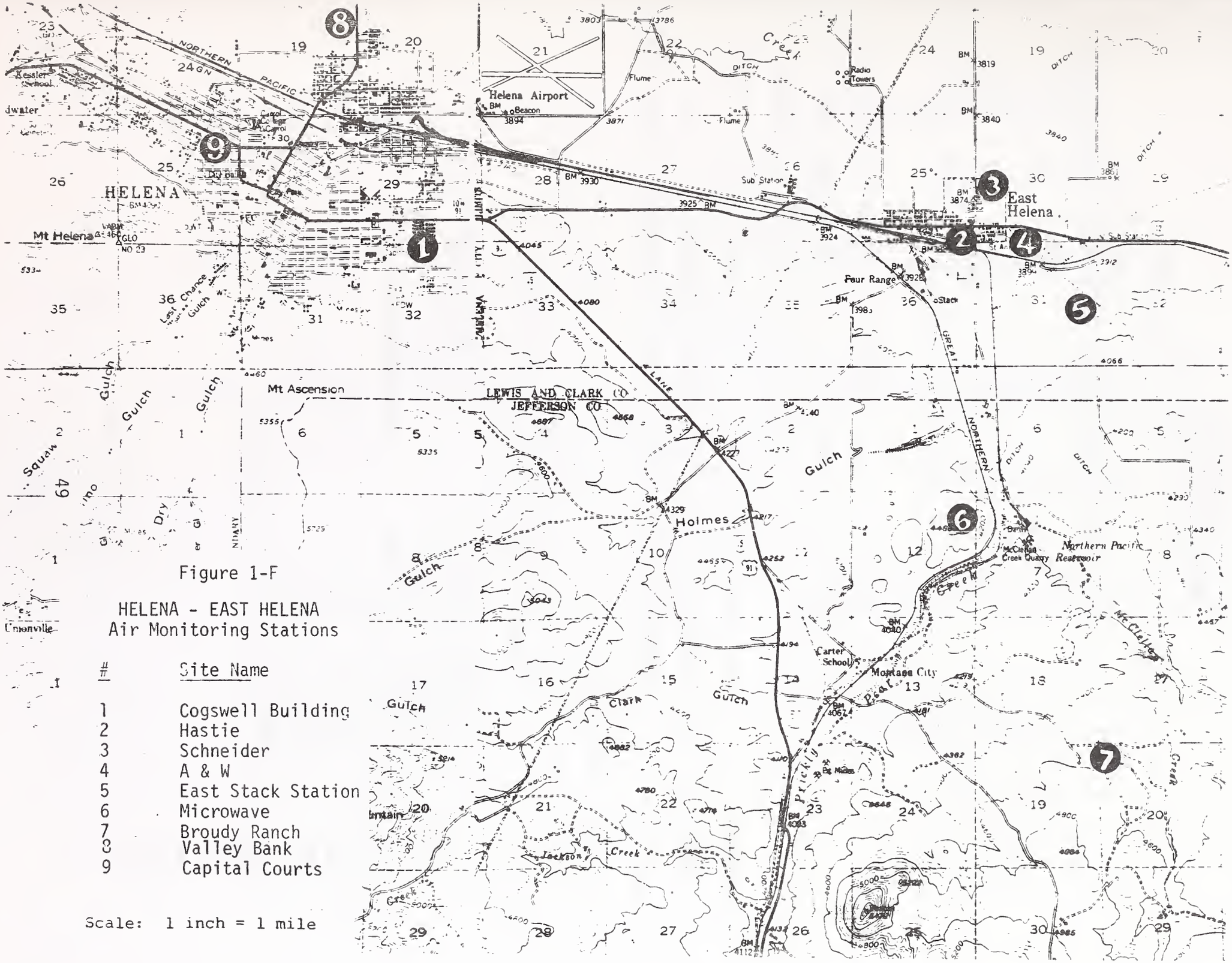


Figure 1-F

HELENA - EAST HELENA
Air Monitoring Stations

#	Site Name
1	Cogswell Building
2	Hastie
3	Schneider
4	A & W
5	East Stack Station
6	Microwave
7	Broudy Ranch
8	Valley Bank
9	Capital Courts

Scale: 1 inch = 1 mile

Table F-II
Helena-East Helena - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
E. Helena-Hastie	79	182	181	86	346	160
E. Helena-A & W	--	--	--	67	194	156
Microwave	33	89	69	--	--	--
Helena-Capital Courts	--	--	--	*70	244	149
Helena-Cogswell	53	211	155	*59	199	163
Helena -Valley Bank	--	--	--	*55	156	153

*Less than eight months of data

Sulfur dioxide (SO_2) was monitored at four locations around East Helena in 1979 and 1980. Due to changes in the ASARCO smelter, monitoring costs and a need to monitor where the people are located; the three remote sites were shut down and a new site was established in the town of East Helena. Sulfur dioxide levels were quite low throughout both years. One-hour maximums of .72 and .50 ppm occurred in 1979 and 1980 respectively. Table F-III summarizes the SO_2 data for these two years.

Table F-III
Helena-East Helena Area - Sulfur Dioxide
Parts Per Million

	East Stack Station - 1979		Microwave Station - 1979	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.20	.01	.26	.01
Feb	.33	.01	.72	.02
Mar	.12	.01	.39	.01
Apr	.07	.01	.21	.00
May	.13	.01	.30	.00
Jun				
Jul			.09	.00
Aug			.06	.00
Sep			.13	.00
Oct			.12	.01
Nov				
Dec				
Annual Average:	.01		.00	

Table F-III, continued

	Broudy Ranch - 1979		East Helena A & W - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.17	.00	.260	.011
Feb	.15	.01	.090	.010
Mar	.08	.00	.115	.007
Apr	.04	.00	.200	.007
May	.05	.00	.032	.002
Jun			.065	.006
Jul	.08	.00	.140	.006
Aug	.06	.00	.320	.009
Sep	.06	.00	.133	.008
Oct	.19	.00	.245	.010
Nov	.03	.00	.334	.001
Dec	.05	.00	.504	.017
Annual Average:		.00		.008

Table F-IV lists metal, sulfate, and nitrate data obtained by chemical analyses of hi-vol filters from the East Helena area. Metal data is obtained by atomic absorption analysis; sulfates and nitrates by using automated colorimetric methods. The annual lead concentration at the East Helena - Hastie site was the highest of all samplers in the state's network for both 1979 and 1980. The ASARCO lead smelter is probably the largest contributor with other sources being American Chemet, re-entrained dust, and automobiles. Quarterly averages for lead from this site exceed the Federal standard of 1.5 ug/m^3 for a calendar quarter. The annual concentrations of arsenic and cadmium are also highest in the state; there are no standards for these metals. Sulfate and nitrate analysis of hi-vol filters serve as indicators of pollutant gases, the first of SO_2 and the latter of NOx. Both parameters show similar results at all three East Helena sites.

Table F-IV
East Helena Area - Metals, Sulfates, Nitrates
Micrograms per Cubic Meter

Site		1979 Mean	1979 1-High	1979 2-High	1980 Mean	1980 1-High	1980 2-High
Hastie	As	0.191	0.895	0.766(12)	0.230	0.554	0.500(4)
	Cd	0.139	1.733	1.324(12)	0.133	0.743	0.351(4)
	Pb	2.95	10.84	7.85 (12)	2.47	8.07	7.42 (12)
	NO_3	1.7	8.4	6.6 (12)	2.3	7.6	5.5 (4)
	SO_4	7.5	16.4	15.1 (12)	8.7	19.6	15.8 (4)
A & W	As	--	--	--	0.078	0.286	0.164(4)
	Cd	--	--	--	0.048	0.169	0.086(4)
	Pb	--	--	--	0.75	5.64	2.07 (4)
	NO_3	--	--	--	1.9	6.5	4.5 (4)
	SO_4	--	--	--	7.5	15.9	13.5 (4)
East Helena-Microwave	As	0.021	0.082	0.068(10)	--	--	--
	Cd	0.025	0.165	0.146(10)	--	--	--
	Pb	0.33	2.19	1.54 (10)	--	--	--
	NO_3	1.6	6.6	6.5 (10)	--	--	--
	SO_4	5.9	15.2	12.2 (10)	--	--	--

Helena area winds are predominantly from the northwest through the southwest. Oftentimes, during the winter months, the winds do not have sufficient velocity to blow out pollutants trapped in the valley by temperature inversions.

G. MISSOULA

G. MISSOULA

The Missoula study area centers around the city of Missoula and is contained within Missoula County. The city is located at the confluence of the Clark Fork and Bitterroot Rivers at an elevation of 3,200 feet. The Missoula Valley floor forms a deep pocket with the surrounding mountains: Bitterroot Range to the west and southwest; Sapphire Mountains to the southeast, and the Reservation Divide to the north. The area is subject to severe temperature inversions during winter months; this traps the pollutants and allows concentrations to build up in the valley.

Population for the area increased substantially from 1970 to 1980; Missoula County increased 29 percent from 58,263 to 75,432, while the city increased 10 percent from 29,497 to 32,841. This dramatic increase influences Missoula Valley pollution problems.

Table G-I lists Missoula area air monitoring sites and Figure 1-G shows those air monitoring sites on a map of Missoula.

Major sources in the area include the following:

1) Kraft paper mill (particulates, H_2S, other sulfur compounds)

2) Two plywood plants (fine particulate and hydrocarbons)

3) Particle board plant (fine particulate, hydrocarbons)

4) Several sawmills (particulate)

5) Automobiles (NOx, CO, re-entrained particulate)

6) Woodstoves and fireplaces (CO, fine particulate and hydrocarbons)

Table G-II summarizes TSP data for the Missoula hi-vol sites. Missoula has consistently had some of the highest TSP readings in the state. In 1977 Missoula was designated non-attainment for TSP (see Appendix C). This was due to high readings (in excess of the Federal 24-hour standard of 260 ug/m^3) throughout the year. Five sites showed annual averages in excess of the Federal standard (75 ug/m^3) in either 1979 or 1980.

TABLE G-I

Missoula Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Missoula Courthouse Roof	Missoula	Missoula City County Health Dept. (MCCHD)	Population Oriented	Center City - Commercial	City-County Courthouse-Corner of Woody Street & W Pine
Lions Park	Missoula	State AQB	Population Oriented	Suburban - Residential	Corner of Bancroft & Kent St.
Rose Park	Missoula	MCCHD	Population Oriented	Center City - Residential	NE Side Sunset Memorial Park - 1/2 blk from Hiway 93S
McLeod Park	Missoula	State AQB	Population Oriented	Center City - Residential	Park approx. 4 blks W. of Hiway 93 S
Shilling Street	Missoula	MCCHD	Population Oriented	Suburban - Residential	Corner of Shilling & Davidson Street
Malfunction Jct.	Missoula	State AQB	Population Oriented	Center City - Mobile	Junction of Brooks, Russell & South Avenue
Missoula County-HW#1	Missoula	MCCHD	Source Oriented	Rural-Industrial	Railroad bluff near Hoerner Waldorf
Missoula County-HW#2	Missoula	MCCHD	Source Oriented	Rural-Industrial	Well Field
Missoula County-HW#3	Missoula	MCCHD	Source Oriented	Rural-Industrial	Big Flat Road

*Site discontinued in 1980

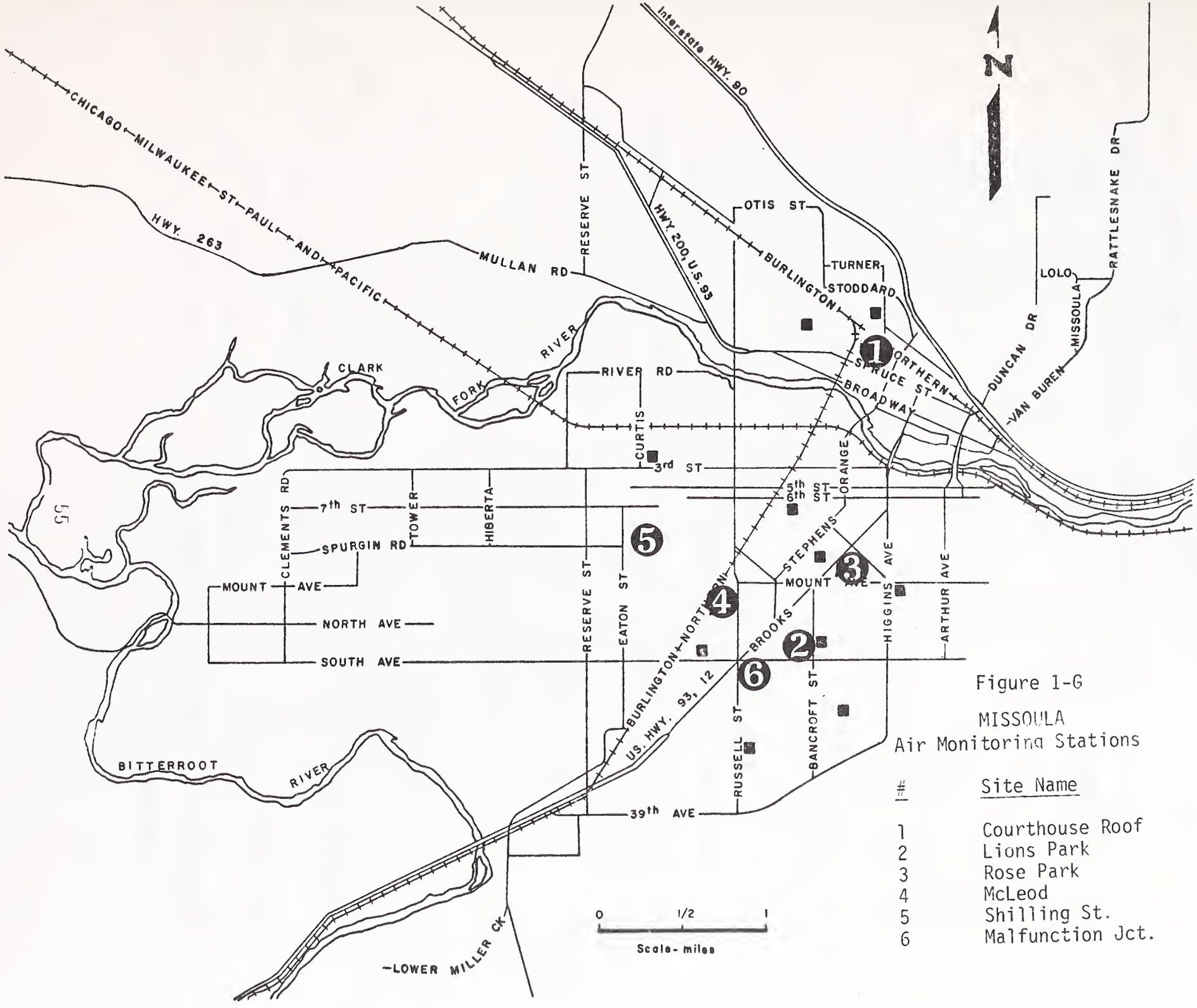


Figure 1-G

MISSOULA
Air Monitoring Stations

#	Site Name
1	Courthouse Roof
2	Lions Park
3	Rose Park
4	McLeod
5	Shilling St.
6	Malfunction Jct.

Table G-II
Missoula Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Courthouse Roof	71	267	252	78	357	286
HW #1	37	149	147	33	213	171
HW #2	37	157	139	33	211	209
HW #3	*33	96	96	--	--	--
Lions Park	82	419	340	*82	502	416
McLeod Park	*103	322	283	101	406	374
Rose Park	79	317	261	79	382	292
Schilling Street	--	--	--	98	464	444

*Less than eight month's data

Respirable particulates (Table G-III) were measured at three sites in conjunction with the MAPS study. These readings were relatively high when compared with other sites around the state. Measuring respirable particulates with dichotomous samplers is a relatively new technique. It is felt that the respirable fraction relates more to health effects than the total suspended particulates.

Table G-III
Missoula Area - Respirable Particulates
Micrograms per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
Courthouse Roof	79	65.0	15.7(10)	72.7	25.8(10)	114.6	41.4(10)
	80	89.2	19.5(10)	156.0	28.4(10)	220.9	47.6(10)
Lions' Park	79	86.6	22.3(11)	184.2	37.6(11)	263.5	59.9(11)
	80	99.2	21.2(9)	136.3	39.6(9)	177.6	60.4(10)
McLeod Park	79	144.6	20.1(10)	140.3	32.4(10)	183.1	52.5(10)

( ) - parentheses denotes number of sample months.

In addition to measuring particulate matter with hi-vols and dichotomous samplers, Missoula county uses an aerosol mass monitor or beta counter to give real time hourly readings of particulate concentrations. This data corresponds fairly well with RP and TSP and is used by county personnel for episode monitoring when high readings occur. No summary of this data is presented in this report; however, it is available upon request.

Missoula heavy metal, sulfate, and nitrate data are presented in Table G-IV. Chemical analysis methods are used to obtain this data from hi-vol filters. None of this data is high enough to cause much concern; the lead data is a little elevated and probably caused by automobile emissions (lead in gasoline).

Table G-IV
Missoula Area - Metal, Sulfate, Nitrate
Micrograms Per Cubic Meter

		1979			1980		
Site	Metal	Mean	1-High	2-High	Mean	1-High	2-High
Missoula - Courthouse	As	0.002	0.016	0.010 (9)	0.003	0.024	0.011 (4)
	Cd	0.004	0.020	0.011 (9)	0.000	0.001	0.001 (4)
	Pb	0.28	1.06	0.98 (9)	0.20	0.50	0.38 (4)
	NO_3	2.1	9.3	8.8 (9)	2.2	15.7	6.8 (7)
	SO_4	3.1	10.2	9.0 (7)	4.8	15.4	9.7 (7)
Missoula - Lions' Park	As	0.002	0.013	0.011 (10)	0.003	0.023	0.011 (4)
	Cd	0.004	0.019	0.014 (10)	0.001	0.004	0.002 (4)
	Pb	0.37	1.09	1.08 (10)	0.19	0.50	0.40 (4)
	NO_3	2.2	10.6	10.1 (7)	2.1	7.7	6.5 (7)
	SO_4	3.0	11.6	916 (7)	4.4	16.9	16.5 (7)

( ) - parentheses denotes number of sample months.

Ozone and nitrogen dioxide were sampled at the Lion's Park site in 1979. Table G-V presents this data. The collected data reveals low concentrations of both pollutants.

Table G-V
Missoula Area - Ozone and Nitrogen Dioxide
Parts Per Million

	Lions Park - O_3 - 1979		Lions Park - NO_2 - 1979	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.038	.004		
Feb	.058	.010		
Mar	.063	.018		
Apr	.060	.025		
May	.041	.019		
Jun				
Jul	.075	.028	.058	.014
Aug				
Sep	.047	.013	.084	.021
Oct	.063	.009	.085	.026
Nov				
Dec				
Annual Average:	.015		.018	

Total hydrocarbons (THC) were measured at the Lions' Park site in 1979 and 1980. Table G-VI summarizes this data. Due to the spottiness of this data, it is difficult to see trends or interpret the significance. Neither the state nor the Federal government have ambient standards for hydrocarbons.

Table G-VI
Missoula Area - Total Hydrocarbons
Parts Per Million

	Lions' Park - 1979		Lions' Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	5.88	2.74	4.63	2.22
Feb	5.25	2.61	5.63	2.39
Mar			3.25	2.00
Apr				
May				
Jun			2.25	1.82
Jul	2.50	1.82		
Aug	2.38	1.87		
Sep	3.13	2.10		
Oct	3.63	2.20		
Nov				
Dec				
Annual Average:	2.36		2.19	

Part of the city of Missoula was designated non-attainment for CO due to high concentrations in the past (see Appendix C). Sampling of CO was conducted at two sites in 1979 and 1980. Both sites showed violations of the eight-hour 9 ppm standard. These high CO concentrations are usually due to automobile emissions. During the last few years we have recorded high CO levels in residential areas; this is probably due to an increased use of wood burning devices in homes. Table G-VII presents the CO data for the Missoula area.

Table G-VII
Missoula Area - Carbon Monoxide
Parts Per Million

	Lions' Park - 1979		Lions' Park - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	24.3	5.6	11.5	2.5
Feb	18.8	3.6	13.2	2.7
Mar	11.5	2.3	3.5	.8
Apr	8.3	1.3	7.0	2.6
May	3.8	1.1		
Jun				
Jul				
Aug				
Sep				
Oct				
Nov				
Dec				
Annual Average:	2.4		2.3	

	Malfunction Junction - 1979		Malfunction Junction - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			11.5	3.4
Feb			13.0	4.0
Mar			8.5	2.7
Apr			7.0	2.5
May			7.5	2.7
Jun			7.8	3.2
Jul			7.8	3.0
Aug			6.8	2.8
Sep			9.5	3.4
Oct			9.5	3.2
Nov			11.0	3.7
Dec	15.3	4.7	17.3	5.2
Annual Average:			3.3	

Wind in Missoula tends to be southwesterly most of the year. It is generally of low speed (1-2 m/sec) and unable to move out temperature inversions.

H. NORTHWESTERN MONTANA

H. NORTHWESTERN MONTANA

The Air Quality Bureau's activities in Northwestern Montana center around the Flathead River Basin Environmental Impact Study. Several sites are operated in Flathead and Lake Counties as part of this project; another site is located in Libby. Table H-I lists the air monitoring sites; Figure 1-H shows the sites on a map of the area. Figure 2-H shows the Flathead River Basin Study area.

The Flathead Study was authorized by Congress and funded through the Environmental Protecton Agency. Air quality is only one portion of the study; other parts include studies of limnology, sedimentation, fisheries, recreation, riparian habitat and soil permeability. The study, originally scheduled for five years, is in its fourth year.

The air quality portion of the study was precipitated by developments which might affect air quality in Glacier National Park and Flathead Valley. The developments include the following:

1) U.S. and Canadian industrial development and mining operations -- particularly the Cabin Creek Coal mine in British Columbia;

2) Population and recreational growth--In 1980 Kalispell's population decreased slightly to 10,299 from 10,526 in 1970, while Flathead County increased by 30 percent from 39,460 in 1970 to 51,462 in 1980.

The topography of Flathead and Libby Valleys is very similar to the Missoula Valley. The inhabited areas, around 3000 feet in elevation, are surrounded by mountains reaching 8-10,000 feet. As a result temperature inversions and poor ventilation are common; this is especially evident during the winter months.

TABLE H-I

Northwestern Montana - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Libby					
Brown Res.	Lincoln	State AQB	Population Oriented	Center City - Residential	Corner of Larch & Dakota - 1/2 Block from St. Regis & 4 lane paved road
Columbia Falls					
NAAC	Flathead	State AQB	Source Oriented	Rural - Agricultural	1/2 mi NW of Anaconda Alum.
Anders	Flathead	State AQB	Population Oriented	Center City - Residential	726 First Avenue East
Polson	Lake	State AQB	Special Project	Rural - Agricultural	2 mi E of Polson near Hwy 93
Ronan	Lake	State AQB	Special Project	Rural - Unqualified	1 mi S of Ronan near Hwy 93
Big Fork	Flathead	State AQB	Special Project	Suburban - Residential	Big Fork Ranger Station W Side of Hwy 35
Kalispell					
Strom	Flathead	State AQB	Population Oriented	Center City - Residential	Behind house at 534 4th Ave. E
Universal Athletic	Flathead	State AQB	Population Oriented	Suburban - Commercial	Roof of Universal Athletic Supply - 226 Main Street
Polebridge	Flathead	State AQB	Special Project	Remote	Polebridge Ranger Station in Glacier Park

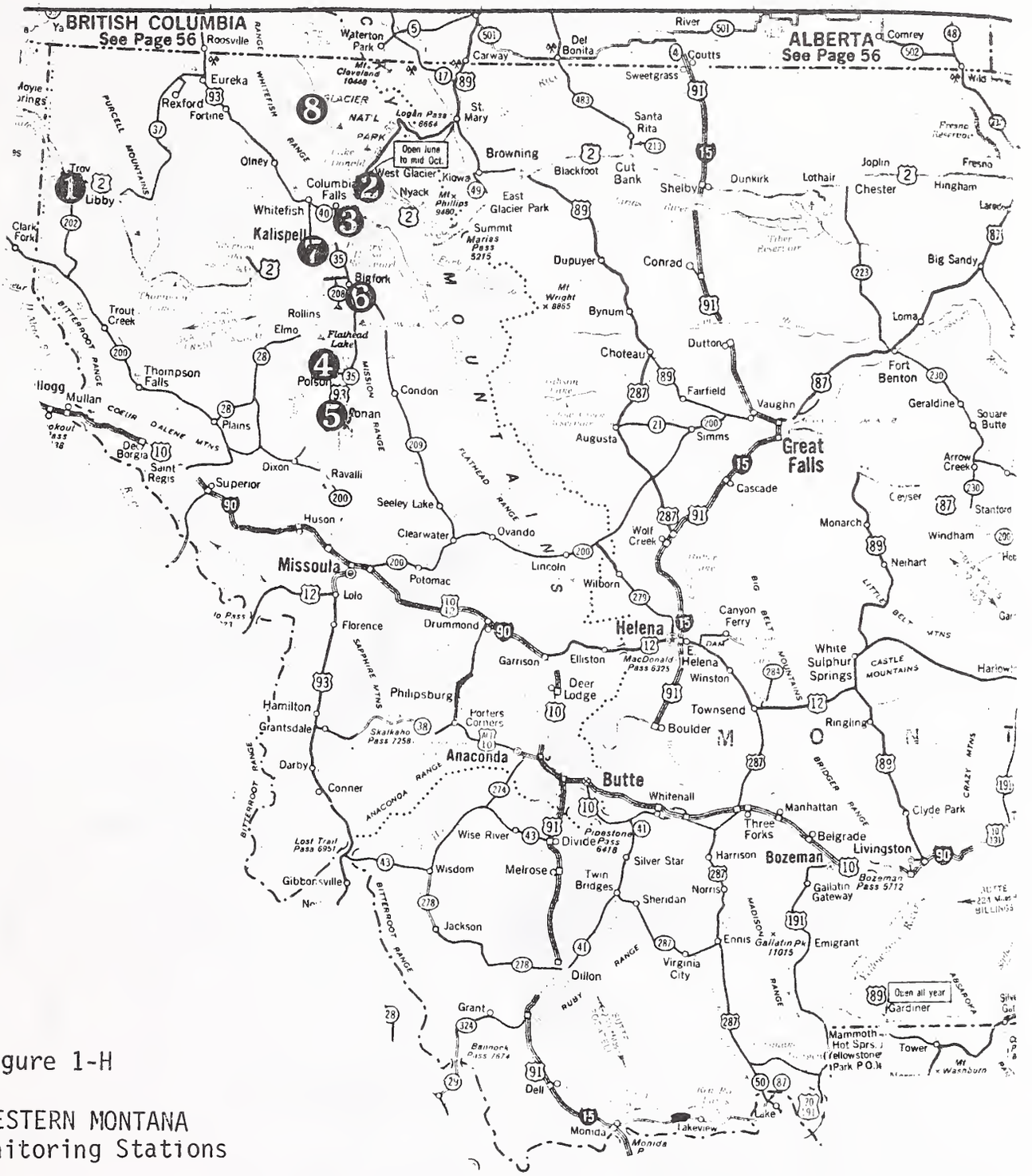


Figure 1-H

NORTHWESTERN MONTANA
Air Monitoring Stations

#	Site Name
1	Brown Res.
2	NAAC
3	Anders
4	Polson
5	Ronan
6	Bigfork
7	Kalispell(4 sites)
8	Polebridge

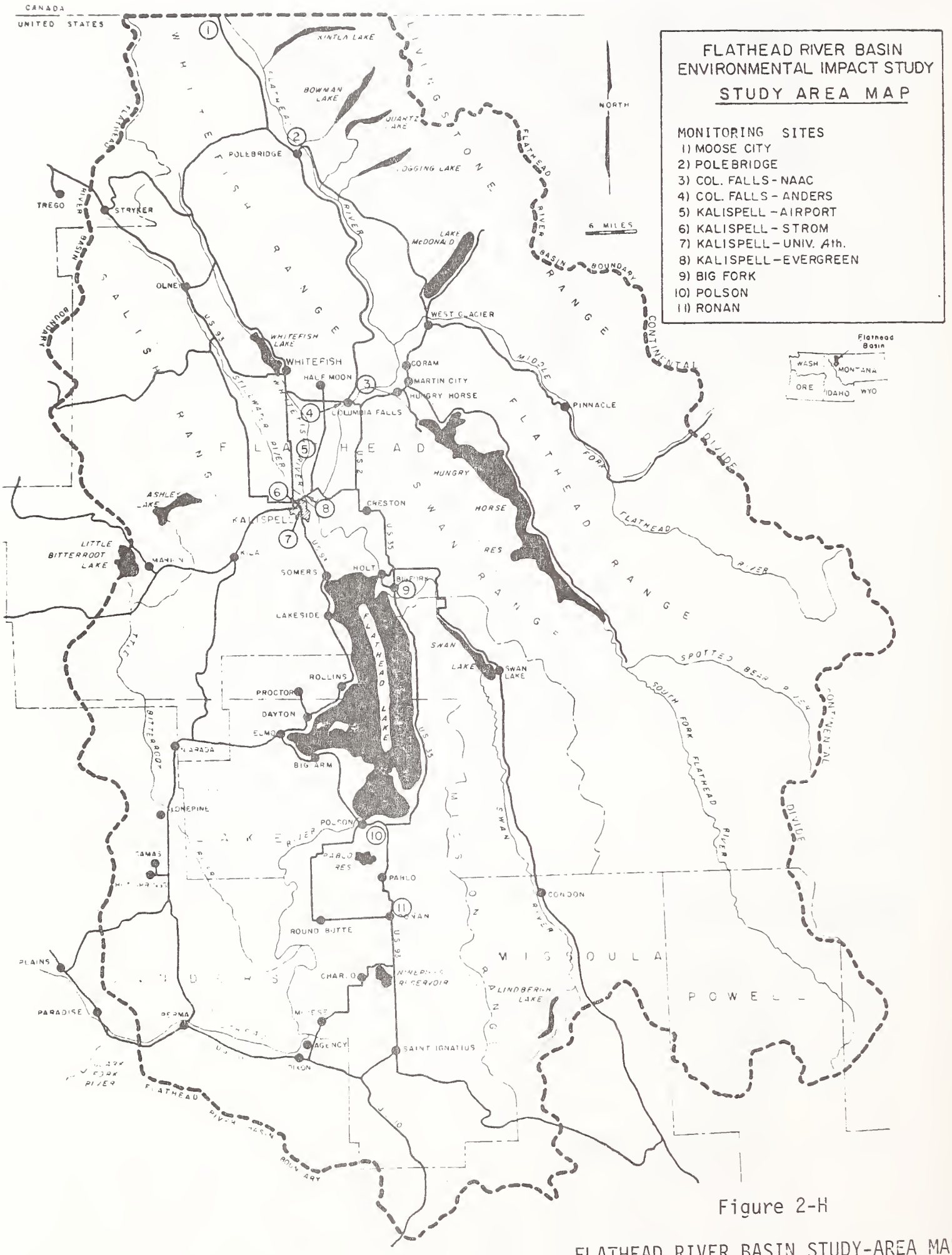


Figure 2-H

FLATHEAD RIVER BASIN STUDY-AREA MAP

Sources of pollution by county include the following:

Flathead County

1) Aluminum reduction plant (fluoride, particulates, SO_2)
2) Two plywood plants (particulates, HC)
3) Particle Board Plant (particulates, HC)
4) Seven sawmills (particulates, CO)
5) Four asphalt plants (particulates)

Lake County

6) Three sawmills (particulates, CO)

Lincoln County

7) Plywood plant (particulates, HC)
8) Two sawmills (particulates, CO)
9) Copper-silver mine (particulates)

All Counties

10) Automobile (particulates, CO)
11) Slash and open burning (particulates, CO)
12) Residential wood combustion (particulates, CO)

Table H-II summarize TSP levels in this portion of the state. The Libby site recorded the highest annual average in the state (146 ug/m^3) and the highest 24-hour reading (610 ug/m^3). These values violate both the Federal 24-hour and annual standards. Sites in Columbia Falls, Kalispell and Ronan were also above the Federal annual standard of 75 ug/m^3.

Table H-II
Northwestern Montana - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Big Fork	*38	112	103	36	134	102
Ronan-Disney	78	406	311	*71	220	168
Polson	61	202	191	55	519	177
Flathead Airport	45	140	120	48	309	232
Flathead - NAAC	24	64	63	25	106	81
Kalispell - Evergreen	--	--	--	*59	169	138
Kalispell - Univ. Athletics	--	--	--	92	296	202
Kalispell - Strom	81	343	289	--	--	--
Libby - Brown	146	610	523	128	306	269
Col. Falls - Anders	109	484	390	99	498	455
GNP - #5	--	--	--	*18	81	74
GNP - #8	--	--	--	*12	49	38

*Less than eight month's data

Respirable particulates (Table H-III) are measured by a new device called a dichotomous sampler. These devices separate particulates into two sizes--fine (<2.5 microns) and coarse (2.5-15 microns). It is felt that these small particles have the most potential impact on health.

Table H-III
Northwestern Montana - Respirable Particulates
Micrograms per Cubic Meter
Size Classification Microns

Site	Year	<2.5		2.5-15		<15	
		Max	Mean	Max	Mean	Max	Mean
Universal Ath.	80	80.8	20.6(12)	203.5	46.3(12)	283.1	65.6(12)
Polson	79	76.7	16.1(10)	143.9	37.4(10)	158.2	54.5(10)
	80	39.7	13.5(12)	84.3	15.2(12)	109.1	28.8(12)
Polebridge	79	17.3	7.7(9)	86.6	11.1(9)	106.0	18.8(9)
	80	12.2	4.5(12)	13.9	3.2(12)	21.6	7.8(12)
Flathead-Airport	79	41.4	17.1(10)	68.1	22.9(10)	109.5	39.8(10)
	80	44.5	16.6(12)	174.3	26.5(12)	198.2	45.4(12)
Col. Falls-Anders	80	94.9	18.7(12)	235.5	51.9(12)	263.5	70.4(12)

( ) - parentheses denotes number of sample months

Fluoride is emitted by the Anaconda Aluminum plant near Columbia Falls and is measured in the Columbia Falls and Glacier National Park areas (Table H-IV). The Montana State Board of Health and Environmental Sciences recently approved a vegetation standard for fluoride of 35 micrograms per gram (ug/g) grazing season average with no monthly average to exceed 50 ug/g. Although previous sampling methods (calcium formate papers and sodium formate plates) are not applicable to the new standard, they do indicate high ambient levels.

Table H-IV
Northwestern Montana - Fluorides
Calcium Paper-Micrograms/Sq. Cm - 30 Days

Site	1979 Max	1979 Yearly Avg.	1980 Max	1980 Yearly Avg.
Dehlboms Residence	1.20	.73	.41	.30
Fierstein	.78	.35	.23	.17
RE Owens	.29	.21	.17	.13
Badrock Substation	.83	.34	.41	.24
Dehlbom Field	1.82	.92	.61	.36
Anaconda South	11.42	4.23	4.82	2.37
Teakettle Mtn #1	3.13	2.07	1.52	1.05
Teakettle Mtn #8	.38	.25	.25	.17
Aluminum City	1.80	.97	.84	.53
NAAC Trailer	1.20	.68	.37	.25

Sulfates and nitrates (Table H-V) are measured by chemical analysis of high volume filters. These parameters serve as indicators of gaseous pollutants--sulfate of SO_2 and SO_3 and nitrate of NO, NO_2, and NO_3.

Table H-V
Northwestern Montana Sulfates & Nitrates
Parts Per Million

Site		1979 Mean	1979 1-High	1979 2-High		1980 Mean	1980 1-High	1980 2-High	
Big Fork	NO_3	1.1	4.9	2.4	(6)	0.7	3.9	3.8	(12)
	SO_4	3.0	4.8	4.1	(6)	3.4	8.0	6.5	(12)
Flathead - Airport	NO_3	1.2	3.6	3.0	(9)	1.0	4.0	2.9	(12)
	SO_4	2.6	5.0	4.7	(9)	3.4	7.7	6.4	(12)
Universal Athletics	NO_3	--	--	--		1.3	5.9	5.5	(12)
	SO_4	--	--	--		4.6	8.8	7.1	(12)
Lake - Polson	NO_3	1.3	5.4	3.7	(9)	1.0	3.5	3.1	(12)
	SO_4	2.9	6.6	4.3	(9)	3.9	6.6	6.6	(12)
Lake - Ronan	NO_3	1.6	6.6	6.3	(11)	1.2	5.6	2.7	(7)
	SO_4	2.9	10.8	8.1	(11)	3.5	7.5	5.4	(7)

Visibility was measured at Glacier International Airport. The standard (3×10^{-5} meters^{-1}) is applied only to Class I attainment areas which include national parks, wilderness areas, and some Indian reservations. It equates roughly to being able to see objects clearly at a minimum distance of 21 miles. The data are not summarized in this report, but is available on request.

For a more comprehensive analysis of the data from this area, a copy of the Flathead River Basin EIS Interim Annual Report, June 1981, can be obtained from the Bureau.

I. CENTRAL MONTANA

I. CENTRAL MONTANA

Central Montana air monitoring sites have been grouped together to include those sites in Bozeman, Havre and Lewistown. Prior to 1980, only one site was in operation in these three cities; this was the Traphagen site in Bozeman. As a result of the 1979 Network Review, the Bureau decided to install one hi-vol each in Lewistown and Havre and two more in Bozeman. Table I-I lists the central Montana sites; Figure 1-I shows the sites on a map of the central part of the state.

The primary reasons for installing these sites were population counts and geographic representativeness. Bozeman's population increased nearly 16 percent from 1970 to 1980 (18,670 to 21,611) while Gallatin County increased 32 percent in the same time period (32,505 to 42,821). Havre and Lewistown had only moderate increases. Havre's population increased from 10,558 to 10,842 in the decade, while Lewistown's went from 6,437 to 7,709.

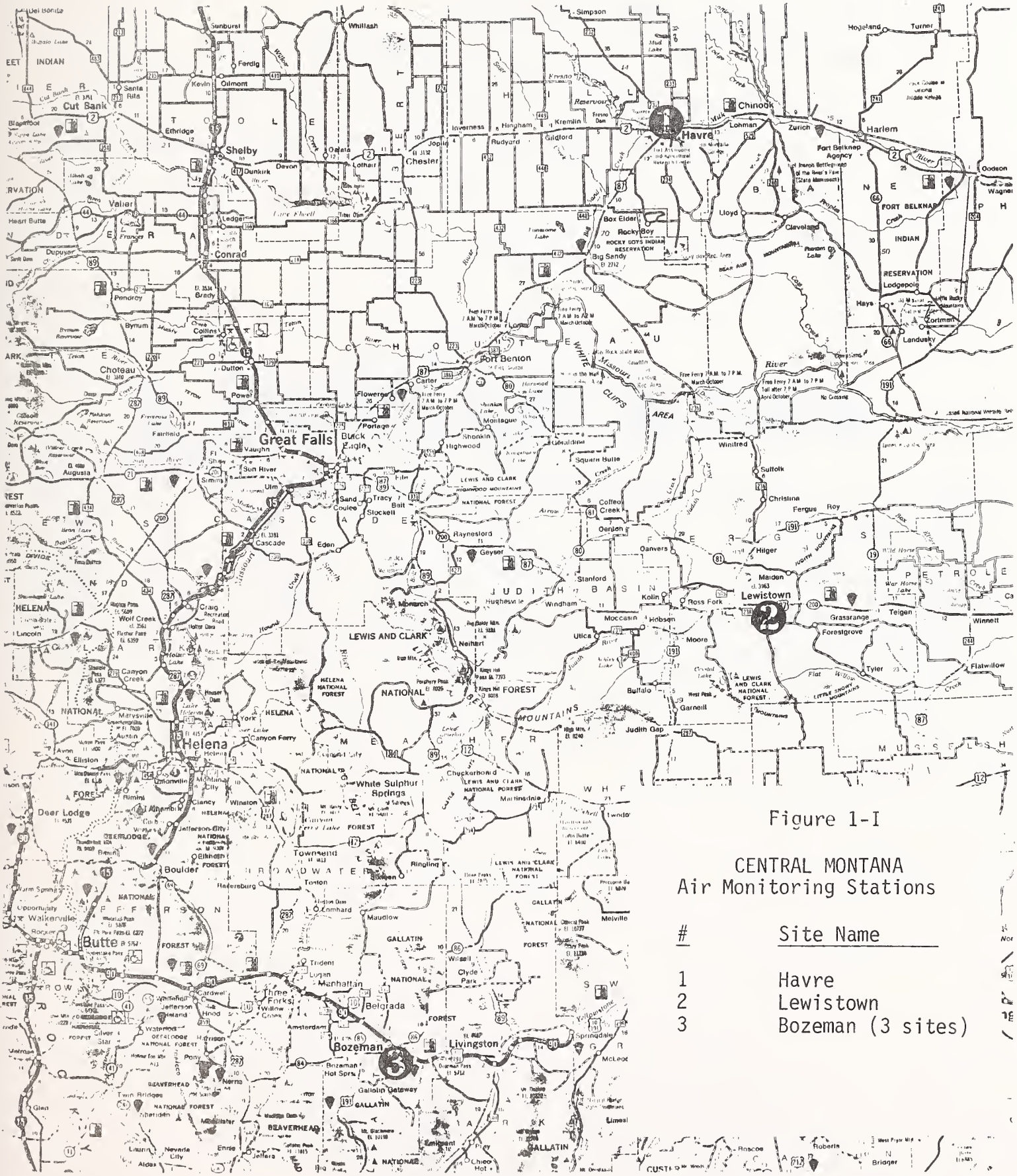
The three cities are all centers of agricultural activity for their areas. Bozeman is the home of Montana State University with an enrollment of about 10,000 students. There are no major industries in any of the cities.

The elevations of the cities are as follows: Bozeman, 4800 feet; Lewistown, 4000 feet; Havre, 2500 feet. Bozeman and Lewistown have similar climates: weather and wind patterns (usually calm) are dictated by local mountainous terrain; each receives about 20 inches of precipitation a year. Havre's climate tends to be more harsh; the winters tend to be cold and windy and the summers hot and dry. Havre receives about 12 inches of precipitation annually. All cities are east of the Continental Divide and experience chinook winds.

TABLE I-I

Central Montana Area Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Bozeman					
Traphagen	Gallatin	State AQB	Population Oriented	Center City Residential	Traphagen Hall, MSU
E. Main	Gallatin	State AQB	Population Oriented	Center City-Commercial	34 No. Rouse Street
MSU Family Housing	Gallatin	State AQB	Population Oriented	Suburban-Residential	MSU Family Housing 19th & College
Havre					
City Bldg.	Hill	State AQB	Population oriented	Center City-residential	520 4th STreet
Lewistown					
Downtown	Fergus	State AQB	Population oriented	Center City-commercial	Roof of Midstate Bank 450 W. Janeaux


Havre
Chinook
Harlem
Great Falls
Fort Benton
Lewistown
Helena
Bozeman
Livingston
Butte
Conrad
Shelby
Cut Bank
Choteau
Valier
Chester
Box Elder
Rocky Boy
Big Sandy
Hays
Landusky
Winifred
Malden
Grassrange
Forestgrove
Winnett
Flatwillow
Roy
Fergus
Christina
Suffolk
Hilger
Oarners
Coffee Creek
Square Butte
Highwood
Montague
Carter
Flowerree
Portage
Black Eagle
Sun River
Vaughn
Augusta
Simms
Ulm
Sand Coulee
Tracy
Stockett
Cascade
Eden
Raynesford
Geyser
Stanford
Windham
Hughesville
Judith Gap
Garneill
Buffalo
Moore
Utica
Hobson
Moccasin
Kolin
Ross Fork
Tyler
Teigen
Neihart
Monarch
Craig
Wolf Creek
Canyon Creek
Marysville
Austin
York
Canyon Ferry
Montana City
Clancy
Winston
Rimini
Ahlmen
Elliston
Avon
Deer Lodge
Jefferson City
Boulder
Townsend
Toston
Radersburg
Ringling
Checkerboard
White Sulphur Springs
Martinsdale
Maudlow
Zonhard
Melville
Wilsall
Clyde Park
Manhattan
Trident
Logan
Three Forks
Willow Creek
Belgrade
Amsterdam
Cardwell
Whitehall
Jefferson Island
Hood
Waterloo
Harrison
Pony
Norris
Gallatin Gateway
Bozeman Hot Spgs
Springdale
McLeod
Big Timber
Roscoe
Roberts
Bridger
Absarokee
Chico Hot
Emigrant
Gardiner
Mt. Blackmore
Mt. Wood
Mt. Douglas
Mt. Ellis
Mt. Baldy
Mt. Hilgard
Mt. Blackwood
Mt. Ellsworth
Mt. Gallatin
Mt. Jefferson
Mt. Haggin
Mt. Evans
Mt. Powell
Mt. Fleecer
Mt. Sheridan
Mt. Tobacco Root
Mt. Torrey
Mt. Hope
Mt. Helena
Mt. Ascension
Mt. Belmont
Mt. Baldy

Pollution sources for all three cities include:

1) Agricultural (particulate)

2) Paved and unpaved roads (particulate)

3) Home heating devices (fine particulate, CO, HC)

Table I-II summarizes TSP data for central Montana. The only site of any major concern is the Bozeman-E. Main site. Although this site represents less than eight months of data collection, it does show a reading in excess of the 24-hour federal standard and a high geometric mean.

Table I-II

Central Montana Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Havre-Central Bldg.	--	--	--	*49	124	117
Lewistown - Downtown	--	--	--	*58	144	142
Bozeman-Traphagen	35	106	93	36	117	115
Bozeman-E. Main	--	--	--	*102	337	281
Bozeman-MSU Family Housing	--	--	--	*58	179	172

*less than eight months data

J. POPLAR RIVER

J. POPLAR RIVER

The Poplar River Study in Daniels County began in March, 1977 to gather background data prior to the start-up of a coal-fired power plant at Coronach, Saskatchewan. The 300 megawatt unit was originally scheduled to go on line in December 1979. Due to construction delays, the plant did not start up until October, 1980.

The Poplar River project was funded by the Federal Government until June, 1981; funding has now been picked up by the State with the project expected to continue until June, 1982.

Air quality in the Scobey-Poplar River area is fairly representative of the entire northeast corner of the state. The area is part of the Northern Great Plains with an elevation of 2000-2500 feet. It tends to have cold, hard winters with persistent high winds. Precipitation for the area averages 12-14 inches per year.

Population for the northeast corner of the state tends to be fairly sparse. Population counts for Daniels, Roosevelt, and Sheridan counties totaled 18,663 in 1980.

Pollution sources for the Scobey area include:

1) Agriculture (particulates)

2) Canadian coal-fired power plant (particulates, SO_2, NOx)

Table J-I provides the monitoring site descriptions for this area; Figure 1-J shows the locations of the sites on a map of the area.

TSP (Table J-II) levels are well below national standards and rise seasonally from summer-fallowing and other agricultural practices. The levels encountered at the Scobey sites compare favorably with other background sites throughout eastern Montana.

TABLE J-I

Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Scobey Border Site	Daniels	State AQB	Background Surveillance	Rural Agricultural	80 yards SE of Canadian Border at US Customs Office
Richardson	Daniels	State AQB	Background Surveillance	Rural-near Urban	1 mi N of Scobey near Hwy 13
Engberg	Daniels	State AQB	Background Surveillance	Rural-near Urban	8 mi NW of Scobey
Hanrahan	Daniels	State AQB	Background Surveillance	Rural Agricultural	SE Corner, Sec. 3, T36N, R49E

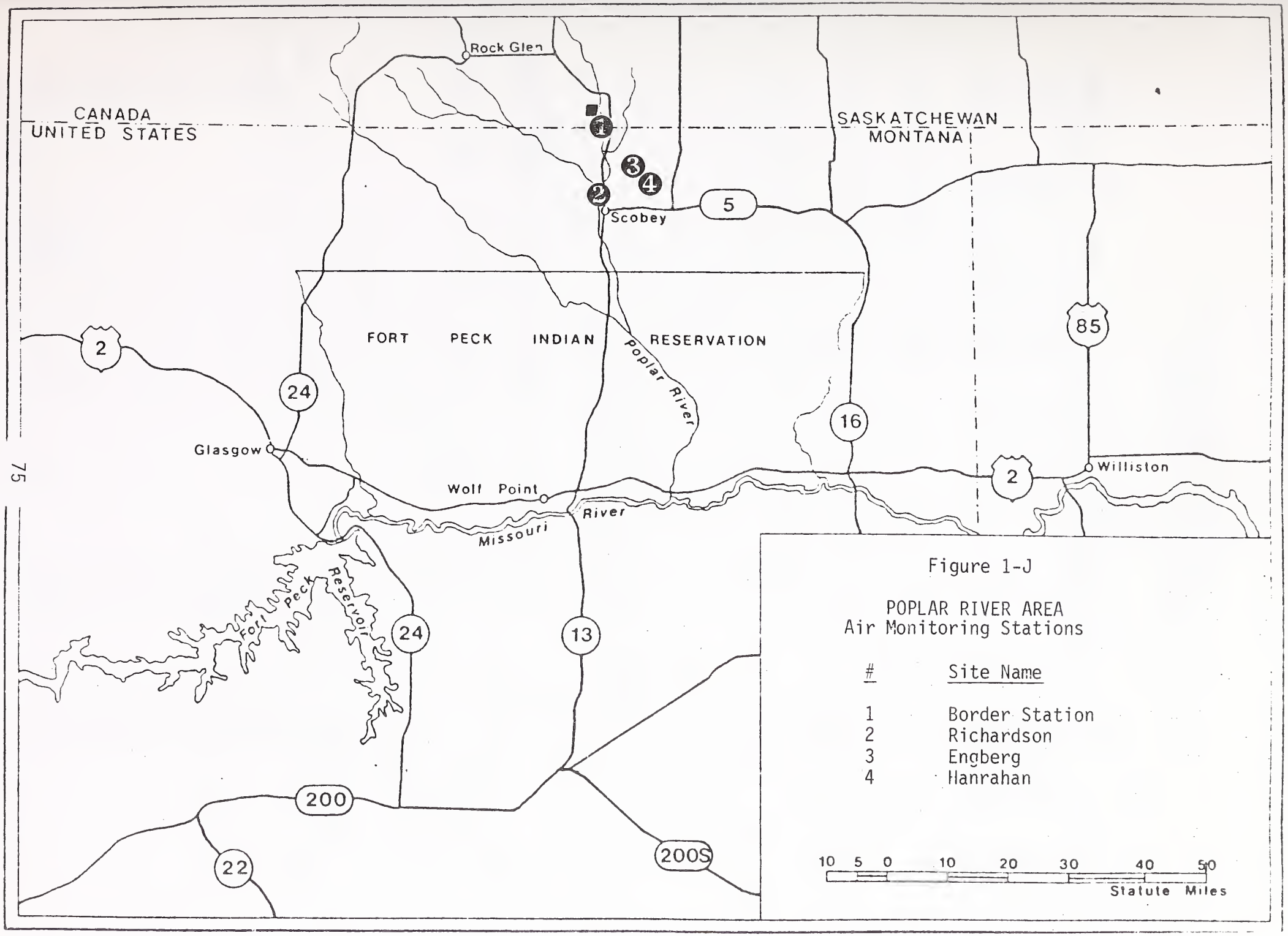


Figure 1-J

POPLAR RIVER AREA
Air Monitoring Stations

#	Site Name
1	Border Station
2	Richardson
3	Engberg
4	Hanrahan

Table J-II
Poplar River Area - TSP
Micrograms per Cubic Meter

SITE	1979 Geo. Mean	1979 1-High	1979 2-High	1980 Geo. Mean	1980 1-High	1980 2-High
Scobey - Border	13	68	53	17	116	115
Scobey - Richardson	17	71	61	21	106	102
Scobey - Engberg	16	84	62	*17	93	86
Scobey - Hanrahan	--	--	--	*14	37	33

*Less than eight months of data

Table J-III summarizes respirable particulate from the Border site. This sampling is done with a dichotomous sampler which splits the particulate matter into two fractions: fine (less than 2.5 microns) and coarse (2.5 to 15 microns). Some RP readings were fairly high but not consistently enough to create concern.

Table J-III
Poplar River Area - Respirable Particulates
Micrograms Per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
Scobey-Border	79	13.9	6.8(9)	41.0	10.0(9)	53.6	17.7(9)
	80	8.2	3.5(8)	123.0	15.5(8)	127.8	19.9(8)

( ) - parentheses denotes number of sample months

Sulfate and nitrate analyses were performed on hi-vol filters using automated colorimetric methods. Values for these parameters are very low and consistent with what would be expected for background sites. Table J-IV summarizes this data for the four hi-vol sites.

Table J-IV
Poplar River Area - Sulfates and Nitrates
Micrograms Per Cubic Meter

Site		1979 Mean	1979 1-High	1979 2-High		1980 Mean	1980 1-High	1980 2-High	
Scobey-Border	NO_3	0.8	2.9	2.8	(12)	0.7	2.4	1.8	(12)
	SO_4	2.6	5.5	5.5	(12)	3.5	20.9	18.6	(12)
Scobey - Richardson	NO_3	0.9	3.8	3.4	(12)	0.9	3.7	2.7	(12)
	SO_4	3.0	6.6	6.2	(12)	4.1	13.9	10.5	(12)
Scobey - Engberg	NO_3	1.0	3.3	3.3	(12)	1.1	3.1	3.0	(6)
	SO_4	3.0	7.6	7.0	(12)	4.0	7.6	6.8	(6)
Scobey - Hanrahan	NO_3	--	--	--		0.7	1.8	1.1	(3)
	SO_4	--	--	--		5.9	4.6	4.6	(3)

( ) - parentheses denotes number of sample months.

Monitoring of sulfur dioxide with a continuous analyzer was started in October, 1979 at the Border site. Table J-V lists a summary of that data. Sulfur dioxide levels are practically non-existent. An hourly maximum of 0.016 ppm was recorded in December, 1980. This occurred after the plant went on line in October, 1980.

Table J-V
Poplar River Area - Sulfur Dioxide
Parts Per Million

	Scobey Border - 1979		Scobey Border - 1980	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.009	.001
Feb			.011	.001
Mar			.006	.002
Apr			.004	.001
May			.008	.001
Jun			.000	.000
Jul			.006	.000
Aug			.002	.000
Sep			.004	.000
Oct	.006	.000	.010	.001
Nov	.004	.001	.004	.001
Dec	.005	.001	.016	.002
Annual Average:	.001		.001	

Visibility in this area is very good. This is primarily due to the excellent ventilation provided by near constant winds.

For a more comprehensive analysis of the data from this area, a copy of Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978, can be obtained from state libraries or the Air Quality Bureau.

APPENDIX A

Glossary of Air Quality Terms

ABSORPTION
- (Engineering) The process of dissolving a gas or one of a mixture of gases in a liquid.
- (Bio-medical) The taking up of fluids or other substances by the skin, mucous surfaces, or absorbent vessels.

ACID MIST
A mist of fine aqueous droplets which contain dissolved acidic compounds, such as sulfuric acid.

ADSORPTION
(1) The adhesion in an extremely thin layer of the molecules of gases or dissolved substances, or liquids, to the surfaces of solid bodies with which they are in contact.

AEROSOL
Suspended particulate matter consisting of smoke, dusts, and fumes which are either solid or droplets of liquids. Aerosol particles vary in size from well below 1 micron to approximately 100 microns in diameter.

AMBIENT AIR
That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY
A physical and chemical measure of the concentration of various chemicals in the ambient atmosphere. The quality is usually determined over a specific time period.

ANTHRACITE
A type of a coal, hard, with high luster, which contains little volatile matter distinguishing it from Bituminous Coal.

AROMATIC
In organic chemistry, designating a large class of organic compounds which contain benzene rings. The simplest aromatic compound is benzene.

ASTM
ASTM (American Society for Testing Materials) is a voluntary organization of companies and individuals, established for the purpose of setting up standard methods of testing, so that different individuals can obtain comparable test results upon the same sample. ASTM Standard Test Methods are available for almost all types of materials, including some on analysis for air pollutants. An ASTM Apparatus is the specific apparatus designated by ASTM for a specific test.

ATTAINMENT AREA
A geographic area in which the quality of the air is better than federal air pollution standards. PSD requirements apply to attainment areas.

ATOMIZING SCRUBBER
A wet collector in which use in made of a liquid medium to increase the size of aerosol particles to facilitate its removal from a gas stream. In an atomizing scrubber, water is introduced at the throat of a venturi through which gas (containing aerosol particles) is moving at high velocity. Units of this type have a high pressure drop, and are used to get high removal efficiencies for particles of relatively small diameters (e.g., below 1.5 microns).

BACT - "Best Available Control Technology"

"The term 'best available control technology' means an emission limitation based on the maximum degree of reduction of each polluted subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant." (Clean Air Act, Section 169(3))

BAGHOUSE

An enclosure containing many cloth bag filters. In dust collection dust laden air entering at the top or bottom of a bag is discharged through the cloth directly to the atmosphere while the solid particles are deposited inside the bag.

BITUMINOUS

A type of coal, soft, which yields considerable volatile matter when heated. Burning this type of coal in open fireplaces or household stoves has caused serious air pollution problems (London, formerly in Pittsburgh and Saint Louis) because of the lack of sufficient temperature above the firebed to burn the volatilized gases and tars. (i.e., both gaseous and particulate emissions).

BRONCHITIS

Inflammation of the bronchial tubes (wind pipe), which include the bronchi (s. bronchus) and the chonchia (s. bronchium), and through which air passes to the lungs.

BULK DENSITY

The quotient of the total mass of a mixture (usually liquid plus solid or gas plus solid)divided by the toal volume.

CARBON DIOXIDE

A colorless, odorless, incombustible gas, CO_2, used to make carbonated beverages, dry ice, etc. It is a product of respiration, combustion, fermentation, decomposition and other natural processes, and is always present in the atmosphere.

CASCADE IMPACTOR

A device for separating dust particles from a moving air stream. In principle a dust particle collides or impacts on solid surface and thus is collected while the air stream moves around the solid surface. An assembly of a series of such surfaces is called a cascade impactor.

CHROMATOGRAPHY

A technique used by chemists to cause the separation of small amounts of chemical compounds in order to determine their identity and quantity.

CLASS I AREA

Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acreas and each national wilderness area over 5,000 acres.

CLASS II AREA
Any area cleaner then federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

CLASS III AREA
Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in a Class III area.

CLEAN AIR ACT
A law enacted by Congress to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

CRITERIA POLLUTANT
A pollutant for which EPA has established a national ambient air quality standard under Section 109 of the Clean Air Act. Present criteria pollutants are: carbon monoxide, hydrocarbons, lead, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulate.

CLOTH FILTER
A cloth bag filter; see BAGHOUSE

COLLECTION EFFICIENCY
The ratio of the weight fraction of aerosol which is retained in the collector to that which entered the collector. Collection efficiency could be specified in terms of particle numbers or other physical characteristics for special cases.

COMBUSTION
The rapid reaction of carbon containing substances (or other oxygen demanding materials) with oxygen producing a rapid temperature increase and a flame.

COMBUSTION CHAMBER
That part of a furnace or incinerator in which burning takes place.

CONING
A name which describes the approximate shape of a smoke plume in a neutral atmosphere (see FANNING).

CONVECTION
(In meteorology) a mechanical process thermally produced involving the upward and downward transfer of a limited portion of the atmosphere.

CYCLONE COLLECTOR
A device for separating solid particles from gases or liquids. The carrier gas or liquid is made to move in a rapid spiralling motion (cyclonic) throwing the solids by centrifugal force to the walls of the collector.

DEPOSITION VELOCITY
The minimum velocity of a small particle suspended in a moving air stream that will give the particle sufficient momentum to carry it into a target (deposit the particle on a collecting surface). At lower velocities the particle will remain in the air stream and go around the target.

DISPERSION
The action of mixing air containing a high concentration of pollutants arising from a pollutant source with the ambient air therby reducing the ambient pollutant concentration.

DUST COLLECTORS
Any device used to remove particulate matter from exhaust streams.

DUSTFALL
The amount of large particulate matter deposited per unit time per unit area of surface.

ELECTROLYTIC BATH
A container of liquid or molten materials through which an electric current is passed to cause chemical decomposition.

ELECTROSTATIC PRECIPITATOR
A device for collecting dispersoids. Particle laden air is passed between two surfaces carrying a high electric potential and under the force of the electric field the particles are driven to a collecting electrode and precipitated.

EMPHYSEMA
The presence of air in the alveolar tissue of the lungs due to rupture of the alveoli. Progressive development of this condition leads to enlargement of the lungs and the chest cavity simultaneously with reduced capacity for breathing and efficiency of breathing.

FANNING
The characteristic appearance of a smoke plume emitted under extreme inversion conditions, where little vertical mixing of smoke in the atmosphere takes place (see CONING).

FLUE GASES
All the gases discharged from any stationary combustion process.

FLUE GAS DESULFURIZATION
One of several processes by which sulfur dioxide is removed from the fuel gas as a disposable solid, elemental sulfur or sulfuric acid.

FLUORIDE
The generic name of all simple chemical compounds containing fluorine, as sodium fluoride.

FLUORINE
A nonmetallic chemical element, a pale yellow, highly corrosive and toxic gas.

FLUOROSIS
Chronic poisoning by flourides.

FLY ASH
The non-combustible particles contained in flue gas.

FOSSIL FUELS
Oil, coal or natural gas.

FUME

Properly, fume is formed of the solid particles formed by sublimation from the gaseous state. The term is frequently used to describe suspensions of very small (submicron) particles.

GASIFICATION

The process of converting solid or liquid fossil fuels to gaseous fuel, usually with the elimination of sulfur.

GRAVITY SETTLING

The application of gravitational force to cause solid particles to drop out of the air. Practically it is useful for removing only particles larger than 50 microns in size.

HALOGEN

Any of the five very active, nometallic chemical elements: fluorine, chlorine, bromine, iodine, and astatine.

HYDROCARBON

Any of the class of compounds consisting solely of hydrogen and carbon.
(1) paraffins whose molecules contain the maximum possible of hydrogen.
(2) aromatics, whose molecules contain benzene rings.
(3) naphthenes, whose molecules are ring shaped.
(4) olefins, whose molecules contain double bonds.

HYDROFLUORIC ACID

A water solution of hydrogen fluoride, HF; it is colorless, corrosive, poisonous and fumes in air.

HYDROGEN

The most simple chemical element and the lightest of all gases. It is found chiefly combined with oxygen to form water; also found in acids, bases, hydorcarbons, etc.

INCINERATORS

Any device to burn solid and combustible liquid residues or wastes in order to reduce their bulk. The ash residue may be used for land fill or dumped at sea. Flue fed incinerators are those where the garbage or refuse is supplied to the combustion chamber through the same flue used for discharge of the products of combustion. A power generating or combination incinerator is one in which the heat from refuce combustion is used to generate steam. Primary air is usually supplied with the material being burned. Secondary air is usually supplied to complete combustion of incompletely burned gaseous fractions over the fuel bed. Tertiary air may be supplied to further improve combustion in a secondary chamber.

INCREMENTS

The amount of additional pollution, beyond already existing background levels, which may be allowed in a particular PSD area. The size of allowable increment varies with whether the area is Class I, Class II or Class III.

INVERSION

A meteorological condition in which the temperature of the atmosphere rises with increased elevation instead of falling; a negative temperature lapse rate.

ISOKINETIC

Having the same speed and direction. On sampling gas streams for certain purposes it is important that the gas flow into the sampler be of the same speed and direction as the main gas stream. This is called isokinetic sampling.

LAER - Lowest Achievable Emission Rate

A requirement applying to proposed new or modified major stationary sources in nonattainment areas. LAER means the "rate of emissions which reflects -

(A) the most stringent emission limitation which is contained in the (SIP) of any State for such class or category of source. . ., or

(B) the most stringent emission limitation which is achieved in practice. . ., whichever is more stringent.

LIGNITE

A naturally occuring coal-like material often having a distinct woody texture.

MACROMETEOROLOGY

Large-scale weather events as opposed to local micrometeorological events.

MERCAPTAN

One of a class of sulfur-containing organic chemical compounds, R-SH, which have an extremely offensive odor.

METEOROLOGY

The science dealing with the atmosphere and its phenomena, particularly relating to weather.

METHANE

The first of the series of hydrocarbons, CH_4. It is a colorless, odorless, flammable gas and is the chief constituent of natural gas.

MICROMETEOROLOGY

The science of small-scale weather events.

MICRON (MU)

A metric unit of measure of length equal to one millionth of a meter and to one thousandth of a millimeter. This unit is much used for describing sizes of airborne particles and is commonly designated by the Greek letter, μ (mu).

NECROSIS

Gradual decay in trees or plants.

NITROGEN OXIDES

Compounds of nitrogen including N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4, N_2O_5. Those most commonly encountered in the atmosphere are nitrous oxide (N_2O), a normal constiuent of the air,and nitric oxide (NO) and nitrogen dioxide (NO_2) which are classified as pollutants.

NONATTAINMENT AREA

A geographic area in which the quality of the air is worse than federal air pollution standards. PSD requirements do not apply in nonattainment areas.

NSPS - New Source Performance Standard
EPA emission standard for certain categories of new or modified air pollutant sources.

OXIDANT
Any chemical element or compound which will cause any other element to increase in positive valence in a chemical reaction. Less precisely, any chemical element or compound, e.g., NO_2, including oxygen which has the same effect as oxygen in a chemical reaction. In photochemical smog, the sum of all compounds detected by reaction with reducing agent, e.g., potassium iodide solution.

OZONE
A form of oxygen, O_3, having three atoms of oxygen to the molecule. It is found in the atmoshpere in minute quantities and is a powerful oxidizing agent. It is a toxic constituent of photochemical smog.

PARAFFINS
A class of saturated hydrocarbons characterized by their chain-like molecular structure. See HYDROCARBON.

PARTICLES
Any solid matter emitted by a pollutant source. It is composed of settleable matter (which will settle as dust within a reasonalbe period of time) and suspended matter (which remains suspended in the atmosphere until washed out by precipitation, deposited by impaction, or some other process).

PARTICULATE MATTER
Finely divided solids or liquids. See AEROSOL.

PHOTOCHEMICAL SMOG
Air pollution resulting from light-induced reaction between certain organic materials and nitrogen dioxide.

PSD - Prevention of Significant Deterioration.
A planning and management process under Sections 160 thru 169 of the CAA for allocation and use of air resources.

RADIATION INVERSION
A type of atmospheric inversion occurring usually at night when the earth's surface loses heat by radiation, thus cooling the layer of air next to the ground. See INVERSION.

RESIDUAL FUEL OIL
The remainder after the more valuable petroleum gas, gasoline, lubricants, paraffin waxes and asphalt are removed from petroleum. This heavy oil is used as fuel and is graded number 4, 5, or 6, with the heavier grades bearing higher numbers. These grades are also cheaper and usually contain more sulfur. The amount of sulfur in the "RESID" depends on the feed stock (source of the crude oil) and the use of dehydrosulfurization processes.

RINGLEMANN CHART
A chart showing four numbered shades of gray as well as pure white and all black, used by visual comparison for estimating the density of smoke as it emerges from a stack. The matched comparison with the chart is referred to as a Ringlemann Number.

SCRUBBER
Any device in which an aerosol is removed from a gas stream by a liquid droplet.

SETTLING VELOCITY
The speed at which an object will move through its surroundings under the force of gravity.

SIP - State Implementation Plan
A state developed, federally approved plan for implementing and enforcing requirements of the CAA.

SMOG
A combination of smoke and fog, usually generated as a result of atmospheric contamination. London (England) type smog arises as a result of the combined presence of sulfur oxides and particualtes in a humid environment. Los Angeles smog or photochemcal smog occurs when sunlight generated reactions involving hydrocarbons, ozone and nitrogen oxide take place. The smog is most visible when high concentrations of water vapor occur in the atmosphere simultaneously but may appear as a bluish haze in a dry atmosphere.

SOOT
Aggregated particles of unburned carbon produced by incomplete combustion. The soot may contain sufficient amounts of sulfur oxides or compounds to damage paint or enamel finishes.

SPRAY CHAMBER
The simplest type of gas scrubber. Gas is passed countercurrent to falling drops of liquid (usually water) from a bank of spray nazzles. A typical application is the removal of fly ash and cinders from flue gases.

STOICHIOMETRIC
In the exact combining proportions of materials involved in a specific chemical reaction.

SUBSIDENCE INVERSION
An atomospheric inversion due to the downward motion or air, about a stationary high-pressure area with concomitant adiabatic temperature rise. Such an inversion is common to Southern California in the warm months of the year. See INVERSION.

SYNERGISM
Cooperative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently.

WET COLLECTORS
Dust collectors which operate by contacting the dust with a liquid (usually water). The class includes spray chambers and atomizing scrubbers.

WIND ROSE
A diagram showing the wind direction and speed and their variations for a day, a month, or any other specified period of time, for a specific location and altitude.

APPENDIX B

Ambient Air Quality Standards

APPENDIX B

AMBIENT AIR QUALITY STANDARDS

In December, 1977, the Montana Board of Health and Environmental Sciences directed the Air Quality Bureau to propose an administrative rule containing new enforceable ambient air quality standards.

A set of standards had been on the books for ten years; however, they were considered as goals or guidelines rather than enforceable standards.

It was decided that before new standards were adopted there should be a thorough review to determine whether the old standards were still appropriate or whether scientific research completed since their adoption indicated different standards were necessary.

Subseqently, $147,000 was provided to hire a staff and consultants. This study was called the Montana Ambient Air Quality Standards Study (MAAQS).

As a result of this work a draft environmental impact statement was published in January, 1979; a final statement in February, 1980.

After several public meetings and experts' testimony, the Board of Health and Environmental Sciences passed a set of "enforceable" standards in August, 1980. Table AP-B-I lists the Montana and national ambient air quality standards. Additional information about the standards is provided on the following page.

Table AP-B-I

MONTANA AND NATIONAL AIR QUALITY STANDARDS

POLLUTANT	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY STANDARD
Total Suspended Particulates	75 ug/m^3 annual average 200 ug/m^3 24-hr average*	75 ug/m^3 annual geometric mean 260 ug/m^3 24-hr average*	60 ug/m^3 annual geometric mean 150 ug/m^3 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-hr average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average 0.30 ppm 1-hr average*	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hr average*	0.12 ppm 1-hr average*
Lead	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average	None
Foliar Fluoride	35 ug/g grazing season 50 ug/g monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering coefficient of 3 x 10^{-5} permeter annual average***	None	None

*Not to be exceeded more than once per year
ug/m^3 micrograms pollutant per cubic meter of sampled air
ppm parts pollutant per milion parts of sampled air

**Not to be exceeded more than 18 times per year.

***Applies to PSD Class I areas

Air quality standards have been developed at the National level for six classes of air pollutants and at the State level for nine pollutants plus visibility. Below is a synopsis of each of the pollutants.

Sulfur Dioxide - Sulfur dioxide originates from the burning of fossil fuels such as coal or oil. The pollutant is known for causing significant loss in crop yield, rusting metals, reducing visibility and irritation of eyes, nose, throat and lungs.

Particulate Matter - Particulate matter may originate in nature such as forest fires and erosion, or result from automobiles, industrial processes, unpaved roads, agriculture, construction and other human activities. These tiny particles can damage paint, reduce visibility, and carry poisonous chemicals into the lungs causing cellular damage.

Carbon Monoxide - Carbon Monoxide is a by-product of the incomplete combustion of organic fuels. The most notorious source is the automobile. This odorless gas can, in small amounts, cause headaches, dizziness, fatigue and slow reactions. It can be especially dangerous for people with heart disease. In larger amounts, it can cause death.

Photochemical Oxidants (Ozone) - Photochemical oxidants are produced in the atmoshphere when hydrocarbons and nitrogen oxides, combustion wastes from gasoline and other fuels, are exposed to sunlight. Oxidants irritate the eyes, nose, and throat, make breathing difficult, reduce visibility, and damage vegetation.

Hydrocarbons - Hydrocarbons are the unburned chemicals from the combustion or evaporation of organic compounds. Automobile exhaust and uncontained storage of petroleum products are common sources of hydrocarbons. They have been known to cause vegetative damage and contribute to photochemical oxidants.

Nitrogen Oxides - Nitrogen oxides usually originate in high-temperature combustion processes including diesel engines. It is not only a component of photochemical oxidants, but causes an unpleasant smelling brown haze, and is irritating to the nose and throat.

Fluoride - Sources of fluorides include the aluminum, glass, brick, fertilizer and, to a smaller degree, the oil industries. In excessive amounts, fluorides can cause bone deformities and damage vegetation.

Lead - Lead in the air is generally the result of automobiles and ore smelters. Physical problems of high lead content include gastrointestinal cramps, central nervous system effects, kidney disease and anemia.

Hydrogen Sulfide - Sources of hydrogen sulfide, the "rotten egg" pollutant include sewage threatment, kraft pulp and oil industries. The pollutant can damage paint, tarnish copper, injure vegetation, produce a loss of the sense of smell, cause severe respiratory tract irritation and in large doses, cause death.

APPENDIX C

Attainment Nonattainment Designations

APPENDIX C

ATTAINMENT-NONATTAINMENT DESIGNATIONS

This appendix briefly summarizes the designation of attainment/non-attainment areas for Montana. For the purposes of this report, we have copied portions of a non-attainment designation document. The copied portions include the general narrative and pollutant attainment status. Specific maps of the area have not been included. For a more complete report, the user can request a copy from the Air Quality Bureau.

I. INTRODUCTION

The 1977 Clean Air Act Amendments, enacted by Congress August 7, 1977, contained many new and expanded requirements regarding the control of air pollution. This report attempts to explain just one requirement contained in the amendments, but a very significant requirement. It is significant not so much in itself, but more in subsequent actions that follow. Section 107(d)(1) of the 1977 amendments requires the states to submit to EPA "...a list, together with a summary of the available information, identifying those air quality control regions, or portions thereof..." classifying these areas according to whether they meet the national ambient air quality standards (NAAQS).

II. CLASSIFICATIONS AND DATA

Standards and Classification Requirements

Five classifications are possible - three for particulate matter (PM) and sulfur dioxide (SO_2) and two for pollutants other than particulate matter or sulfur dioxide. The five classifications are summarized below.

A) Do not meet a national primary ambient air quality standard for oxidants, carbon monoxide (CO) or nitrogen dioxide (NO_2).

B) Do not meet, or in the judgment of the State will not attain or maintain in the time required by the applicable SIP, any national primary ambient air quality standard for sulfur dioxide or particulate matter.

C) Do not meet a national secondary ambient air quality standard.

D) Cannot be classified as (B) or (C), on the basis of available information, for PM or SO_2.

E) Have ambient air quality levels better than any national primary or secondary ambient air quality standard for oxidants, CO, or NO_2, or for which there is insufficient data to be classified (A) or (C).

Areas designated as A, B or C are referred to as non-attainment areas, and areas designated as D or E are referred to as attainment (or unclassified) areas.

Table 1 shows the NAAQS against which air quality data is evaluated to determine the status of areas for the classifications.

These standards apply to ambient air, or the outdoor air to which the public has access. The standard for hydrocarbons, while still legally a standard, is not being used. The primary standards are those levels which the EPA Administrator judges necessary to protect the public health with an adequate margin of safety. The secondary standards are designed to protect the public welfare from any known or anticipated adverse effects from a pollutant, in the Administrator's judgment.

Table 1

National Ambient Air Quality Standards

Pollutant	Primary Standard	Secondary
Total Suspended Particulate Matter	75 ug/m^3, annual geometric mean, 260 ug/m^3, 24-hour average*	60 ug/m^3, annual geometric mean, 150 ug/m^3, 24-hour average*
Sulfur Dioxide	80 ug/m^3 (0.07 ppm) annual arithmetic mean, 365 ug/m^3 (0.14 ppm) 24-hour average*	1300 ug/m^3 (0.5 ppm) 3-hour average*
Carbon Monoxide	9 ppm, 8-hour average* 35 ppm, 1-hour average*	Same
Nitrogen Dioxide	0.05 ppm, annual average	Same
Non-Methane Hydrocarbons	0.24 ppm, 6-9 a.m. average*	Same
Photochemical Oxidants	0.08 ppm, 1-hour average*	Same

*Not to be exceeded more than once per year.

Air Quality Data

The AQB has used, whenever possible, the last four consecutive quarters of air quality data to propose the designations. The 1977 CAAA require the classifications to be made as of the date of enactment which is August 7, 1977. A certain amount of judgment is required throughout this process. Choosing to use data through September, 1977, allows the designations to be made on the basis of the most current data available. Other choices were possible, such as the most recent four quarters ending and including June, 1977, or calendar year 1976, or data collected through July, 1977. The choice of September, 1977, provides very current data and required no consideration of emission reductions that older data might not reflect. The choice also provides a better quality of data than something older, as the data collecting techniques and quality assurance procedures are constantly improving. Also, rainfall in 1976 was extremely low, thus increasing fugitive dust problems from unpaved roads and windblown soil over a more normal year. Appendices A and B to this report contain a summary of the data used for the designations.

The AQB employed two ozone continuous monitors to propose the classification for oxidants. The federal reference method for oxidants measures ozone as it is considered representative of the total oxidant problem.

Data from two continuous NOx monitors were used for the NO_2 proposals. A third monitor has not generated sufficient data from which to propose a classification for the area.

Enough carbon monoxide data have been collected in three areas to propose classifications. In two other areas, insufficient data are available. CO concentrations are determined through use of continuous monitors.

Sulfur dioxide data are available from eleven continuous monitors and several SO_2 bubblers (reference method). All bubbler data in current network show attainment. These bubblers are located in eastern Montana and have been established primarily as background stations. The continuous analyzers are primarily located to monitor the effects from point sources. Data from source-owned monitors have also been used in preparing the designation proposals.

Suspended particulate data are generated from the hi-volume sampler filter, which is the reference method. The data from some 50 stations throughout the state were employed to prepare the proposals for TSP designations.

III. DESIGNATION PROPOSALS

The designation lists include a brief narrative for each of the areas proposed as non-attainment areas, and generally a statement of the values which resulted in the non-attainment classification. The following descriptions of attainment status are those submitted to EPA on January 6, 1978.

ATTAINMENT STATUS - OXIDANTS

The Department is proposing the entire state be unclassified for oxidants. The Colstrip station produced only 112 days data out of 304 days possible in 1977, and the 1976 data are of questionable validity. The Billings site has produced good data, and shows attainment. Also, the data from the two sites collected to date seem to be somewhat contradictory, thus the proposed unclassified status.

ATTAINMENT STATUS - NOx

	Designation		
Designated Area	107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings, MT, Area			*
Colstrip, MT			*
Butte, MT		*	
Rest of State		*	

Summary of Documentation

The Billings site is located in a high traffic area of the Billings urban area, and reflects a "worst case" situation for traffic-related NOx. The data show no violations of the NOx standard (1976 annual average - 0.034 ppm; 1977 annual average - 0.029 ppm). Data validity is questionable but probably within 25%. Even if the data is 25% low, there would be no violation.

Data from the Colstrip site show no violations (annual average - 0.029 ppm) and the data are valid. NOx sources are coal-fired power plants and modeling shows no violations.

Data taken in Butte are inconclusive as only two months data have been collected. No data have been obtained for other areas of the state, and therefore the rest of the state is unclassified.

ATTAINMENT STATUS - CO

Designated Area	Designation 107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings Downtown Area	*		
Butte Area		*	
Colstrip Area		*	
Great Falls		*	
Missoula Area	*		

The Billings area is proposed to be designated non-attainment based on violations of the CO standard at 27th and Montana site. The boundaries in Figure 1 are based on modeling done by PEDCo for the AQMA analysis and are designed to include only that area where violations are predicted to be occurring now.

The Butte, Colstrip and Great Falls areas are proposed as unclassified as the CO monitors have not generated sufficient data to make a determination of attainment/non-attainment.

The Missoula area, Figure 2, has been designated non-attainment with less than one year's data. The data, however, show 55 8-hour averages above 9 ppm, with a maximum 8-hour average of 13.87 ppm. Boundaries have been established using the major arterials including those areas of current traffic volumes which cause violations. The designated CO area is the same as the designated area for TSP primary standard non-attainment.

A lack of data for other areas of the state requires that all areas not specifically listed be unclassified.

ATTAINMENT STATUS - SO_2

Designated Area	Designation: Non-Attainment 107(d)(1)(B) Primary	Non-Attainment 107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Laurel Area	*		
Anaconda Area	*		
East Helena Area	*		
Billings			*
Colstrip Area			*
Rest of State			*

Sulfur dioxide data are valid and show violations at various monitoring stations. Boundaries of non-attainment areas were determined from data and modeling.

The maps attached show the extent of the non-attainment areas above.

The Billings area is proposed as unclassified. SO_2 data in downtown Billings indicate attainment in that general area, but modeling predicts violations near major industrial sources for which no sampling data are available.

The East Helena area designation is based on data showing primary standard violations (e.g., 24-hour average = 0.26 ppm) and modeling which predicts the violations to occur as far as 0.67 km from the smelter. The boundaries are shown in Figure 3.

The Anaconda area designation is based on extensive sampling showing numerous violations of the 24-hour primary standard. Boundaries were established from the monitoring data and are shown on Figure 4.

The Laurel area designation derives from sampling showing 24-hour violations (max. 24-hour = 0.38 ppm) and modeling shows the violations to extend 2.0 km from the refinery as shown on Figure 5.

ATTAINMENT STATUS - TSP

Designated Area	Designation		
	Non-Attainment		
	107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Decker			*
Hardin			*
Billings Downtown		*	
Billings Area			*(1)
Great Falls CBD		*	
Great Falls Area			*(2)
Butte Area	*		
Anaconda			*(1)
Philipsburg			*(1)
East Helena		*	
Three Forks			*(1)(2)
Miles City			*
Ekalaka			*(2)
Fort Peck			*
Lame Deer			*
Scobey			*
Glendive			*
Colstrip	*		
Broadus			*(1)
Lindsay			*(1)
Poplar			*
Columbia Falls	*		
Kalispell			*(1)
Libby			*
Troy			*
Missoula Area	*	*	

(1) Violation of standard due to fugitive dust from non-industrial sources - unpaved roads, etc.
(2) Insufficient data from which to classify the area.

Four areas are listed as secondary standard non-attainment. Maps are attached showing the proposed area boundaries.

The Billings downtown area is marginally above the standards (second high 24-hour 151, annual mean 60.6). The TSP problem stems from vehicle activity but the TSP will be contaminated and should not be considered fugitive dust. The proposed boundary is the Billings Downtown redevelopment area, as indicated on the map (Figure 6). The area includes the area predicted by modeling to be exceeding TSP standards.

A situation similar to Billings is found in Great Falls. The annual mean is 59.8 ug/m^3, with nine readings above 150 ug/m^3 and a maximum of 869 ug/m^3. The proposed boundary is the Great Falls CBD, shown in Figure 7.

**The Butte area exceeds both secondary standards significantly with an annual mean of 72.9 ug/m^3 and a second high of 226 ug/m^3. The boundary shown in Figure 8 is established by air quality modeling and does not follow any established area.

The East Helena area (Figure 9) is a localized problem which is proposed for designation because of the nearness of an industrial slag dump and contaminated soil.

Three areas are proposed to be designated as non-attainment for primary standard. The three areas are Colstrip, Columbia Falls and Missoula, and maps are attached depicting the boundaries.

The Colstrip area designation is based on company data showing significant violations of both the annual standard (annual mean 107 ug/m^3) and 24-hour standard (high value = 428, second high value = 379). The state station in the area does not show violations but these data do not represent the mining activity as the sampler is on top of a hill several hundred feet above the mining. This site was chosen to reflect power plant emissions, rather than low-level sources. Area boundaries include the mines and surrounding areas as shown in Figure 10.

The Columbia Falls site shows an annual mean of 68.4 ug/m^3 and second high of 271 ug/m^3. While a substantial portion of the problem probably stems from fugitive dust, the presence of several industrial sources in the area necessitates the non-attainment designation. The proposed boundary is the city limits of Columbia Falls as per Figure 11.

The Missoula area is proposed for designation, based on an annual mean of 77.4 ug/m^3 and six days above the 24-hour standard. Proposed boundaries are based on modeling performed for AQMA analysis and include all areas exceeding the primary standard. The area is also proposed for designation as non-attainment for the secondary standard. The boundaries are consistent with the AQMA analysis for predicted violations and are shown on Figure 12, primary, and Figure 13, secondary.

The remainder of the sites that show violations are due to fugitive dust as defined in the EPA policy paper, or have insufficient data on which to make a decision.

**Butte area, originally proposed non-attainment of the secondary TSP standard, was designated non-attainment of the primary standard by the EPA after the last quarter of the year's data was included. The annual average was greater than 75 ug/m^3

The 1977 CAAA require that all areas of the state be classified. As previously discussed, there are, in effect, only two classifications - attainment (which includes unclassified) and non-attainment. If an area is designated as non-attainment, the implementation plan is required to include the non-attainment provision as specified in Part D of the Act (42 USC 7501 et seq). If an area is designated as attainment, the applicable SIP is to include the Prevention of Significant Deterioration (PSD) requirements of Part C (42 USC 7470 et seq).

Non-Attainment Areas

The requirements for a non-attainment plan depend on the pollutant for which the area is designated. For TSP or SO_2, the plan requirements are primarily directed at point sources; for CO, NO_2, or oxidants, the requirements are directed at mobile sources (motor vehicles).

Prior to promulgation of a revised plan, all major emitting facilities (emissions of more than 100 tons per year) are subject to EPA's "offset" policy. This policy requires that before any new facility can locate in an area, total emissions, including the new source, be sufficiently less than total emissions allowed without the new source to constitute reasonable progress toward attaining the standard. This means that existing sources must reduce emissions in order that the new source be permitted. There are provisions for waiver of the offset requirement providing the state has a permit program which will accomplish the same result; i.e., less total emissions in the area.

After July 1, 1979, the full requirements of a non-attainment plan must be in force. These include the application of all reasonably available control measures as expeditiously as practicable, annual incremental reduction in emissions, a comprehensive accurate current emission inventory, public, local government and State legislative involvement, and a restrictive permit program as specified in Section 173 of the Act. This permit program shall provide for annual incremental reductions in emissions, that new or modified sources comply with emission limitations which are the most stringent contained in any SIP or actually achieved in practice, whichever is lower, and that all sources under the control of the owner of the new or modified source are in compliance or on a schedule for compliance with applicable emission limitations.

This non-attainment plan is to achieve the primary NAAQS by December 31, 1982. For TSP and SO_2, no extensions are possible. For CO and/or oxidants, however, it is possible for EPA to grant an extension of this date to December 31, 1987. This extension can be granted if, despite the application of all reasonably available measures, attainment for these pollutants is not possible by 1982. This demonstration must be made before the date on which the plan is to be submitted (January 1, 1979).

If such a demonstration is made, the plan must contain three additional elements. It must include a program for analysis, for proposed new major sources, of alternatives regarding location, sizes, production processes and control techniques to demonstrate that "benefits of the proposed source significantly outweigh the environmental and social costs..." The plan must include a schedule for implementation of a vehicle emission control inspection and maintenance program, and identify the measures necessary to attain the standard by December 31, 1987.

A designation of a non-attainment area for CO or oxidants brings into play some other sections of the Act, most notably Sections 174 and 175. Congress has indicated a desire that local governments be responsible for implementation planning whenever possible, as stated in Section 174(a), as follows:

"Within six months after the enactment of the Clean Air Act Amendments of 1977, ...the State and elected officials of affected local governments shall jointly determine which elements of a revised implementation plan will be planned for and implemented or enforced by the State and which such elements will be planned for and implemented or enforced by local governments or regional agencies, or any combination of local governments, regional agencies, or the State. Where possible within the time required..., the implementation plan required by this part shall be prepared by an organization of elected officials of local governments.... Where such an organization has not been designated by agreement within six months after the enactment of the Clean Air Act Amendments of 1977, the Governor..., after consultation with elected officials of local governments, ... shall designate an organization of elected officials of local governments in the affected area or a State agency to prepare such plan."

Section 175 of the Act authorizes full federal funding for the first two years of plan development. Section 325 authorizes the appropriation of $75,000,000 for these purposes, but no appropriation was made. The money actually available to local governments for this may be minimal.

Congress has also mandated certain economic sanctions (Section 176). For example, the Secretary of Transportation is not to approve any projects, nor award any grants, for projects in a non-attainment area where transportation control measures are necessary for attainment if the state by July 1, 1979 (July 1, 1982, if extension obtained) has not submitted a suitable implementation plan. Safety, mass transit, and transportation improvement projects can be approved if air quality improvement-related.

Attainment Areas

If an area falls into the attainment or unclassified categories, the SIP must then contain the requirements of Part C, Prevention of Significant Deterioration, Sections 160-169. This portion of the Act sets limits for how much deterioration in air quality in an area will be considered significant. Congress essentially followed EPA's regulatory scheme of 1975, and made it law.

V. SUMMARY

Designation of an area, or lack of data, results in application of provisions of the 1977 CAAA having far-reaching and rather long-term effects. The non-attainment plans will require stricter permit standards and restrictive emission limits for both new and existing sources (offset), increased local government involvement, and potential economic sanctions for transportation related projects. The PSD provisions mandate an extensive (and expensive) pre-construction review, restrictive emission limits, additional monitoring requirements, and the realization of means of limiting growth using air quality considerations.

APPENDIX D

Summary of the Montana Air Pollution Study

APPENDIX D

SUMMARY OF THE MONTANA AIR POLLUTION STUDY
by Stephen Medvec

Introduction

A major four-year study by the Air Quality Bureau of the State Department of Health and Environmental Sciences of the effects of air pollution on human health in several of Montana's urban areas ended in June 1981. The Montana Air Pollution Study (MAPS), which was funded initially by the 1977 Montana Legislature for two years, and then extended by the 1979 session for an additional biennium, has cost $1.5 million. Fourteen interim reports have been published, and the project's final report was issued in June.

The 1977 Montana Legislature requested that air pollution-health effects studies be implemented in the cities of Anaconda, Billings, Butte, and Missoula, as well as in the towns of Columbia Falls, Colstrip, East Helena and Hardin. Bozeman and Great Falls were added during the initial study design to provide data from relatively unpolluted areas for comparison purposes. The study areas are located for the most part in mountain valleys or river canyons, where prolonged periods of air stagnation are common during the fall and winter.

The following studies were performed during the project: lung (pulmonary) function testing of school children and persons with respiratory diseases; screening for the presence of possible carcinogenic substances in the air and in children's urine in the Butte-Anaconda area; and a mortality study to determine numbers of deaths possibly related to air pollution in three counties during the period 1970-75.

Results

Pulmonary Function Testing

Results of comparative pulmonary function tests conducted in Anaconda, Billings, Butte, Great Falls and Missoula during the 1978-79 school year showed that Great Falls children, who were exposed to the least urban air pollution

levels, had the best pulmonary performance. Children from Missoula, with the highest particulate levels, and Anaconda, with the highest sulfur dioxide levels, had the worst pulmonary performance. Billings and Butte children were found to have readings between the two extremes. The study also revealed that in most cases females reacted more adversely to air pollution than males.

An analysis of pulmonary function measurements among Missoula children during the 1978-79 and 1979-80 school years showed consistently that as particulate levels in the air increased, pulmonary performance decreased. No significant decrease in the children's pulmonary ability was demonstrated following exposure to extremely high levels of volcanic ash in a separate analysis of data collected one week after the eruption of Mount St. Helens on May 18, 1980.

In 1978-79 an 18-month study of 84 adults with chronic obstructive pulmonary disease (COPD) was conducted. Results also showed decreasing pulmonary performance, as well as notable increases in coughing, wheezing and shortness of breath, with increasing air pollution levels.

Carcinogenic Screening in Butte-Anaconda

Measurement of the mutagenic potential of substances has become a standard procedure throughout the world to assess the carcinogenicity of substances, i.e., their potential for causing cancer. The Ames test predicts whether a substance will be carcinogenic on the basis of its mutagenicity to certain strains of bacteria. The MAPS project adopted this specific methodology to assess cancer risk in the Butte-Anaconda area.

In 1978-79, urine testing was conducted at three elementary schools in Anaconda and Butte, where lung cancer rates are low. Eleven Butte children, out of 80 sampled, had mutagen levels considered to be signficantly elevated. No Anaconda children reached these levels, and the levels of mutagen among Bozeman

children were not significant. The Butte children with elevated mutagen levels lived relatively near Front Street, a major east-west thoroughfare running parallel to the railroad tracks. The different mutagen levels between Anaconda and Butte test groups support the existing assumption that the two communities differ in distribution of carcinoma types and risk patterns between men and women.

Mortality Study in Three Counties

A 1974 review of Montana's vital statistics revealed that some counties had abnormally high death rates from asthma, chronic bronchitis, emphysema, cerebrovascular disease, and lung cancer, especially within the 40-65 age group. After an analysis of the data had been completed, Deer Lodge, Lake and Silver Bow Counties were selected for a more detailed investigation of possible causes for the high death rates. Although strong suspicion remains that exposure to ambient air pollution may have contributed to high death rates among residents of the three counties from lung cancer, respiratory diseases and cerebrovascular disease, it cannot be proven conclusively because of the variable of undocumented smoking habits. There may be a synergisitic effect from air pollution exposure and smoking.

Conclusion

Prior to undertaking the study pollution researchers, such as Drs. Benjamin Ferris of Harvard University and Ian Higgins of the University of Michigan were of the opinion that a correlation between increased air pollution and decreased lung performance could not be demonstrated at air pollution levels found in Montana.

MAPS, however, has confirmed the hypothesis that increased air pollution levels cause a decrease in lung functioning.

APPENDIX E

List of MAPS Technical Reports

APPENDIX E

List of MAPS Technical Reports

Health Effects

1. Johnson, K.; Schwaller, R.; Wing, B. et al. Pulmonary Function Testing of Patients with Chronic Obstructive Pulmonary Disease (September 1979).

2. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Wing, B. et al. Pulmonary Function Testing of Elementary School Children (October 1979).

3. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Medvec, S.; Simms, M. et al. Relationship Between Human Health and Inhalable Particulates (October 1980).

4. Warren, G.; Rogers, S.; and Medvec, S. Mutagen Screening in an Isolated High Lung Cancer Mortality Area of Montana (June 1979).

Air Quality

1. Gelhaus, J. Air Quality Data Summaries for Anaconda-Butte, Billings, Missoula, and Columbia Falls/Hardin/East Helena/Colstrip (February 1981).

2. Robbins, H.; Driscoll, P.; Myren, B. et al. Air Monitoring Instrumentation (October 1979).

Meteorology/Modeling

1. Gelhaus, J. et al. Meteorological Summary - First Year (July 1979).

2. Gelhaus, J. and Harner, S. Deer Lodge Valley Dispersion Study (July 1979).

3. Gelhaus, J. Meteorological Summary - Billings (February 1981).

4. Gelhaus, J.; Machler, M.; and Stewart, T. Montana Air Resources Modeling System (August 1979).

5. Middlemist, T.; Robbins, H.; and Zimmerman, L. Missoula Valley Dispersion Study (September 1980).

6. Nelson, B.; Machler, M.; and Robbins, H. Deer Lodge Valley Dispersion Study (October, 1980)

Emission Inventory

1. Bohn, R.; Cowherd, C.; Keller, R.; and Raisch, R. Update and Improvement of the Emission Inventory for MAPS Study Areas (November 1979).

2. Raisch, R.; Williams, G.; Bohn, R.; and Cowherd, C. A Study of the Feasibility of Performing an Inventory of Historical Emissions at Butte and Anaconda, Montana (November 1979).

Systems Design

1. Lynn, D. et al. Computer Information System Development (November 1979).

APPENDIX F

List of Air Quality Reports

APPENDIX F

LIST OF AIR QUALITY REPORTS

Maughan, D.; Sternberg, S. A Network Review of Montana's Ambient Air Monitoring (April, 1979).

Machler, M.; Robbins, H. 1980 Network Review (October, 1980).

McAllister, D.; Ruby, M.; Vichorek, D.; Crowley, F. Final Environmental Impact Study, Montana Ambient Air Quality Standards Study (February, 1980).

Gelhaus, J.; Machler, M.; Schwartz, S.; Roach, M. Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978 (August, 1979).

Gelhaus, J.; Machler, M. Meteorological Study, Columbia Falls, Montana (March, 1979).

Robbins, H., et al. Quality Assurance Policy (December, 1980).

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for July 1979 through September 1980 (June 1980).

Erickson, R.; Tomlinson, W.; Steffel, R.; Baxter, T. Survey of Residential Wood Use in Helena, Bozeman, Great Falls, and Kalispell, Montana (June, 1981).

State of Montana Air Quality Rules (August 1980)

Clean Air Act of Montana (July 1979)

APPENDIX G

Point Source Emission Estimates

APPENDIX G

POINT SOURCE EMISSION ESTIMATES

The following two tables list emission estimates from various industrial sources in the State. Table AP-G-I lists sulfur dioxide emissions; Table AP-G-II lists particulates.

Table AP-G-I

SULFUR DIOXIDE EMISSION ESTIMATES FOR 1980

Source	SO_2 Tons/Yr	County	City
Exxon Co., USA	10735	Yellowstone	Billings
Farmers' Union CENEX	10380	Yellowstone	Laurel
Montana Power Co. (Corette)	9811	Yellowstone	Billings
Continental Oil Co.	3051	Yellowstone	Billings
Montana Sulfur	2136	Yellowstone	Billings
Great Western Sugar	711	Yellowstone	Billings
Westmoreland Resources	* 57	Big Horn	Hardin
East Decker Coal	* 46	Big Horn	Decker
West Decker Coal	* 46	Big Horn	Decker
Spring Creek Coal	* 17	Big Horn	Hardin
Philips Petroleum	1172	Cascade	Great Falls
Rainbow Resources	200	Glacier	Browning
WESTCO	12	Glacier	Cut Bank
Anaconda Co. Smelter	** 126642	Deer Lodge	Anaconda
ASARCO	28740	Lewis & Clark	East Helena
Ideal Basic Industries	130	Gallati	Trident
Anaconda Co. Butte Operations	* 117	Silver Bow	Butte
Kaiser Cement	44	Jefferson	Montana City
Montana Dakota Utilities	2192	Richland	Sidney
Shell Oil, gas plant	1278	Richland	Sidney
Perry Petrolane, gas plant	867	Richland	Sidney
Valley County Ind. Park	174	Valley	Glasgow
American Colloid	63	Phillips	Malta
KENCO	55	Roosevelt	Wolf Point
Western Energy Coal	* 46	Rosebud	Colstrip
Peabody Coal	* 17	Rosebud	Colstrip
Anaconda Co. Aluminum	2646	Flathead	Columbia Falls
Champion Int., Packaging Div.	541	Missoula	Frenchtown
W. R. Grace	452	Lincoln	Libby
Burlington Northern tie plant	42	Sanders	Paradise
Stoltz Land and Lumber	37	Ravalli	Darby

*Includes tailpipe emissions from diesel powered vehicles.

**Only six months of operation.

Table AP-G-II

POINT SOURCE PARTICULATE EMISSION ESTIMATES FOR 1980

Source	Part. Tons/Yr	County	City
West Decker Coal	*2136	Bighorn	Decker
Spring Creek Coal	*2001	Bighorn	Hardin
East Decker Coal	*1995	Bighorn	Decker
Westmoreland Resources	*1180	Bighorn	Hardin
Montana Power (Corrette)	989	Yellowstone	Billings
Exxon Co. USA	612	Yellowstone	Laurel
Continental Oil Co.	249	Bighorn	Billings
Bighorn Calcium	* 240	Bighorn	Warren
Great Western Sugar	114	Yellowstone	Billings
Anaonda Co. Refinery	414	Cascade	Great Falls
Phillips Petroleum	116	Cascade	Great Falls
Anaconda Co. Butte Operations	*5144	Silver Bow	Butte
Kaiser Cement	475	Jefferson	Montana City
Stauffer Chemical Co.	410	Silver Bow	Ramsay
Anaconda Co. Smelter	384	Deer Lodge	Anaconda
ASARCO smelter	310	Lewis & Clark	East Helena
STANCO General	* 238	Deer Lodge	Anaconda
Pfizer Talc	175	Beaverhead	Dillon
Ideal Basic Industries	* 152	Gallatin	Trident
Louisiana Pacific Corp.	* 139	Powell	Deer Lodge
Cyprus Industrial Minerals	132	Gallatin	Bozeman
Western Energy	*4796	Rosebud	Colstrip
Peabody Coal	*1164	Rosebud	Colstrip
Montana Power Co. 1 & 2	887	Rosebud	Colstrip
Holly Sugar	389	Richland	Sidney
Knife River Coal	* 150	Richland	Savage
Northern Cheyenne Forest Prod.	* 140	Rosebud	Ashland
Montana Dakota Utilities	132	Richland	Sidney
Anaconda Aluminum	1331	Flathead	Columbia Falls
Louisiana Pacific Particleboard	761	Missoula	Missoula
Champion Int. Packaging	756	Missoula	Frenchtown
St. Regis Paper Co.	696	Lincoln	Libby
Missoula White Pine & Sash	* 384	Missoula	Missoula
Stoltz Land & Lumber	* 374	Flathead	Columbia Falls
Champion Int.	287	Missoula	Bonner
Plum Creek Lumber	* 275	Lake	Pablo
Flathead Lumber	224	Lake	Polson
American Timber	* 209	Flathead	Olney
Plum Creek Lumber	199	Flathead	Columbia Falls
Flodin Lumber	* 180	Sanders	Thompson Falls
Plum Creek Lumber	149	Flathead	Kalispell
W. I. Forest Prod. Inc.	* 122	Sanders	Thompson Falls
Louisiana Pacific	* 113	Sanders	Trout Creek
Ksanka Lumber	* 112	Lincoln	Fortine

*Fugitive emissions associated with mining and vehicle traffic are included.

APPENDIX H

Prevention of Significant Deterioration

APPENDIX H

PREVENTION OF SIGNIFICANT DETERIORATION

Prevention of Significant Deterioration (PSD) requirements were first introduced as part of the 1977 Amendments to the Clean Air Act.

These PSD requirements set limits for increases in ambient pollution levels and established a system for preconstruction review of new major sources. Three PSD classes have been established. Class I permits very small increases in pollution; Class II allows somewhat larger increases; and Class III allows the air quality to "deteriorate" considerably more. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory Class I areas. These mandatory areas include international parks, wilderness areas larger than 5000 acres, national memorial parks larger than 5000 acres, and existing national parks larger than 6000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

Table AP-H-I shows the allowable increases for the various classes. Table AP-H-II lists the federal Class I areas for Montana and Figure AP-1-H shows the locations of these areas on a map of Montana.

In 1978 the state of Montana established its own PSD rules. These rules were closely patterned after the Federal rules. In 1979 the EPA was sued by the Alabama Power Company over the Federal PSD rules. The court ruled that EPA had misinterpreted the intent of Congress. As a result the EPA rewrote their rules, which now differ from Montana's rules. The significant difference between the two sets of rules is that the state counts fugitive dust and uncontrolled plant emissions as part of the increment consumption.

TABLE AP-H-I

FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION
ALLOWABLE INCREMENTS
Micrograms per cubic meter

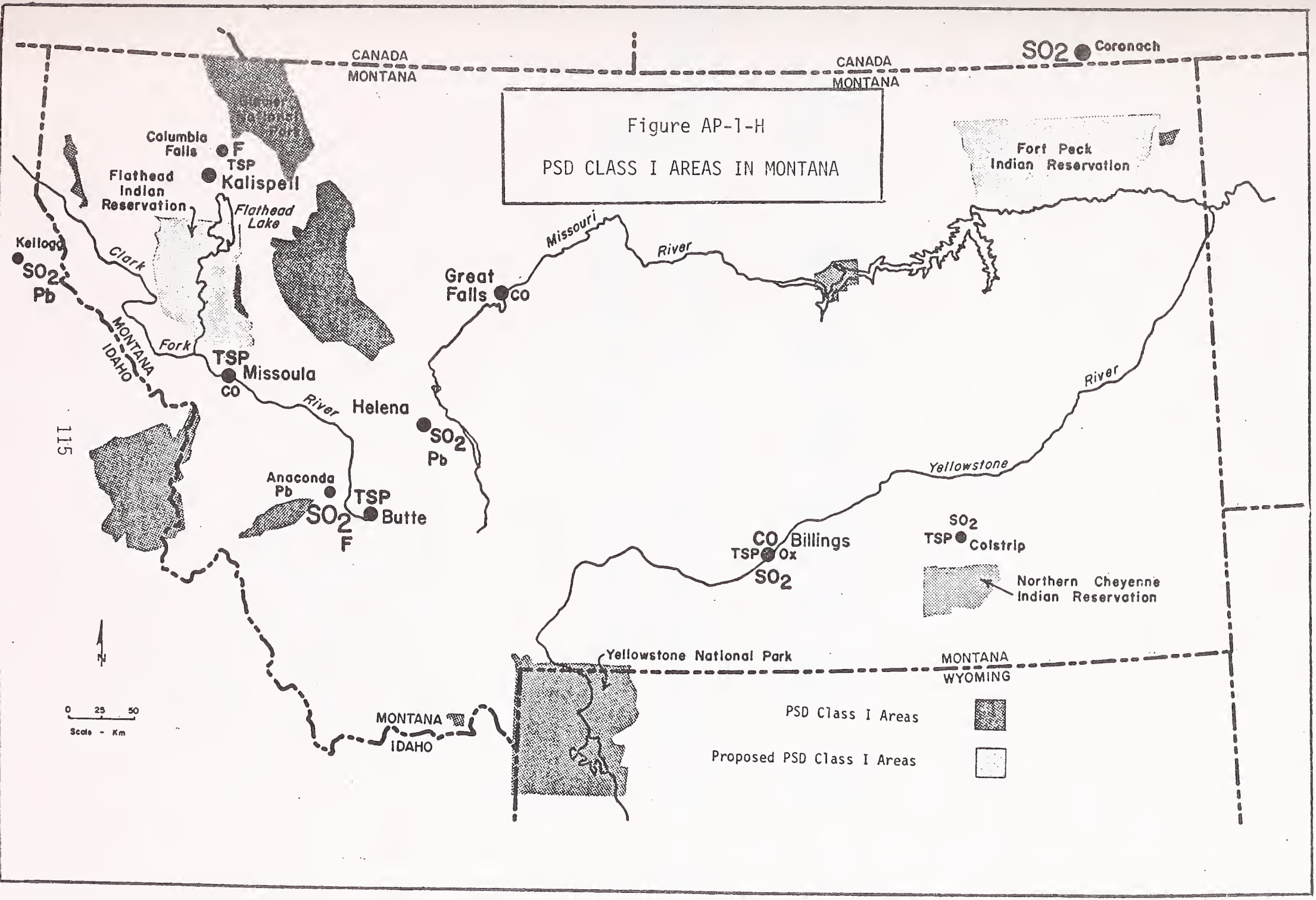
	I	II	II-Mod.*	III	Not to exceed
Particulates					
Annual Geo. Mean	5	19	19	37	75
Maximum 24-hour	10	37	37	75	150
Sulfur Dioxide					
Annual Arith. Mean	2	20	20	40	80
Maximum 24-hour	5	91	91	182	365
Maximum 3-hour	25	512	325	700	1300

*Applies to plants near Class I areas

TABLE AP-H-II

MONTANA FEDERAL CLASS I AREAS

Area	Location
Glacier National Park	NE Kalispell
Yellowstone National Park	S Bozeman
Bob Marshall Wilderness Area	SE Kalispell
Anaconda-Pintlar Wilderness Area	SW Anaconda
Selway-Bitterroot Wilderness Area	W Hamilton
Cabinet Mountains Wilderness Area	S Libby
Scapegoat Wilderness Area	NW Helena
Gates of the Mountains Wilderness Area	NE Helena
Mission Mountains Wilderness Area	SE Polson
Red Rock Lakes National Wildlife Refuge	S Virginia City
Medicine Lake National Wildlife Refuge	S Plentywood
U. L. Bend National Wildlife Refuge	SW Glasgow
Northern Cheyenne Reservation	SE Hardin


CANADA
MONTANA
CANADA
MONTANA
SO2 Coronach
Figure AP-1-H
PSD CLASS I AREAS IN MONTANA
Columbia Falls
F
TSP
Kalispell
Flathead Indian Reservation
Flathead Lake
Kellogg
SO2
Pb
Clark
Fork
MONTANA
IDAHO
TSP
Missoula
CO
River
Helena
SO2
Pb
Great Falls
CO
Missouri
River
Fort Peck Indian Reservation
Yellowstone
River
Anaconda
Pb
TSP
Butte
SO2
F
CO
TSP
Ox
SO2
Billings
SO2
TSP
Colstrip
Northern Cheyenne Indian Reservation
Yellowstone National Park
MONTANA
WYOMING
MONTANA
IDAHO
115
N
0 25 50
Scale - Km
PSD Class I Areas
Proposed PSD Class I Areas

APPENDIX I

Unforeseen Emergency — Mount St. Helens

APPENDIX I

UNFORESEEN EMERGENCY - MOUNT ST. HELENS

On Sunday, May 18, 1980, Mount St. Helens erupted in the State of Washington. By early evening the western edge of Montana started to receive a dusting of ash from the volcano.

The Bureau has received a number of requests for information and data collected during this emergency. To meet these needs, we have put together a variety of information. First, we have included a personal account by one of the bureau members entitled "Week of the Ash"; this gives a chronology of events during the week following May 18.

Table AP-I-I gives ash concentrations taken from various state hi-vol sites on approximately four-hour intervals. Figure AP-1-I graphs Missoula's data. Highest concentrations occurred on Monday, with another peak occurring on Wednesday. Wednesday's highs were due to re-entrained dust caused by winds picking the dust off the ground.

WEEK OF THE ASH
By Stan Sternberg

Eight a.m., Monday morning, May 19, 1980. It was time for the regularly scheduled weekly staff meeting. The time for the meeting was the only thing routine that day. The agenda's one topic: the volcano in Washington had erupted and ash was pouring into Montana - what are we going to do?

The telephone was ringing off the hook. No secretaries had shown. Mike Roach, Air Quality Bureau Chief, called the meeting to order. "Take those phones off the hook", someone yelled, "how can we rack our brains with all that ringing?" The phones were taken off. Quiet. The chief asked the first question, "What do we know about this thing?" One by one we went around the table. Apparently the ash was fairly typical crustal earth material: mostly aluminum, calcium, iron, potassium, magnesium and silicon.

"What ambient air data do we have?" Through a series of phone calls, Mike Machler had gotten the operators in Butte and Missoula to start running air sampling filters at midnight. The first data that came in showed a 24-hour reading for Sunday in Missoula of 3071 micrograms per cubic meter. We had never seen readings of that magnitude.

"What emergency powers do we have?" Details were sketchy but we did have an Emergency Avoidance Plan under the State Implementation Plan. This was a source specific curtailment plan; we could shut down industries if the ambient levels were above 875 micrograms per cubic meter. We also had some emergency provisions to control fugitive dust. This would allow us to slow down traffic to 15 mph in urban areas.

With what information we had during that early morning meeting, Mike Roach assigned the staff a series of duties. Dave Maughan: call around and find out more about the composition of the ash. Bob Raisch: find out what emergency provisions we have and if we can declare an emergency. Jon Bolstad: call other state and regional agencies and find out what they know as well as what the volcano is doing. Dennis Haddow: call physicians and determine what health effects the ash may have. Stan Sternberg: set up monitoring in Helena and East Helena. The rest of the staff were to stay close and answer phones. Another meeting was set for 11 a.m. A voice called out, "Get those phones back on line and let 'em ring."

This was the start of the week of the ash. The outside temperatures were hot; the ash and closed windows brought a muggy, close, brow-wiping environment.

By Monday afternoon a functional monitoring network had been established. Operators in several counties were running filters every four hours and calling in the data.

At 1:30 p.m. on Monday, the Governor declared a statewide emergency. On Tuesday, the first counties were withdrawn from the emergency, they were in the southwest and south central portions of the state. Counties in the east were phased down through the warning and alert levels. The ash seemed to stick stubbornly in the valleys of the west. Missoula had problems with reentrainment (ash being picked up off the ground by wind and cars).

On Tuesday afternoon, Bob Raisch and Hal Robbins flew over a portion of the state to evaluate the situation. This included flying over Havre, Kalispell, and Missoula. The bulk of the ash was between 0 and 5,000 feet and the highest ash elevation was around 14,000 feet. Bob said he could

see the top of the Sweetgrass Mountains for 60 miles; the bottoms could be seen for only five miles. Mike Machler took a similar flyover on the following day.

The scene at the Cogswell Building was a bee hive. Thousands of phone calls came in. Calculators were humming. A board was set up to record the data. The office was manned twenty-four hours a day. Some staff members didn't sleep for two days.

On Thursday, Kalispell got some rain. "Come on rain!" the staff chanted. By Friday afternoon the whole western part of the state had rain. The ash was washed out of the sky and by 1:00 p.m. on Friday the emergency was lifted from all counties. The phone was still ringing but less frequently. At 5 o'clock we all went home. The rain looked great....fresh ....clean....ah!

MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

AIR QUALITY BUREAU

AMBIENT AIR QUALITY DATA--VOLCANIC ASH FROM MOUNT ST. HELENS--MAY 18, 1980 ERUPTION--TOTAL SUSPENDED PARTICULATES--MICROGRAMS PER CUBIC METER ($\mu g/m^3$)

SITES	5/18	5/19					5/20						5/21						5/22						5/23		
Missoula Crthouse	0000/ 2400 3071 3071	0000 1200 9298 6368		1245/ 1545 7620 7088	1530/ 1930 19228 9318	1930/ 2230 6656 8985	2230/ 0230 2520 7908	0230/ 0630 844 7874	0630/ 1030 676 6177		1420/ 1815 2055 2336	1820/ 2220 3197 1858	2220/ 0220 1848 1724	0220/ 0620 1231 1801	0620/ 1020 1100 1886	1020/ 1420 1648 1847	1420/ 1820 7617 2774	1820/ 2220 4853 3050	2220/ 0230 2341 3132	0220/ 0620 1309 3145	0620/ 1000 784 3092	0950/ 1350 894 2992	1350/ 1750 941 1659	1750/ 2150 274 1099	2150/ 0640 31 477	0640/ 1040 50 357	
Butte Hebgen Park		0000/ 0800 3439 3439	0800/ 1200 2513 3186	1200/ 1500 1642 2849	1600/ 1900 431 2429	1900/ 2300 327 2063	2300/ 0215 518 1854	0215/ 0620 203 1578	0620/ 1020 263 665	1020/ 1415 272 335	1420/ 1800 252 305	1805/ 2200 276 290		2200/ 0510 326 281		0550/ 1350 325 306		1350/ 2150 608 420		2050/ 0500 140 358		0630/ 1345 387 453		1400/ 2200 332 280	2200/ 0600 50 252		0500/ 1324 [illegible] 156
Gt.Falls CCHD		0000/ 1030 7165 7165		1200/ 1515 3898 6393	1500/ 1900 4399 5943	1935/ 2135 4484 5689	2235/ 0145 3372 4345	0155/ 0600 1247 3828	0600/ 1015 1090 3110	1015/ 1415 304 2483	1420/ 1720 384 1547	1738/ 2150 431 1082	2150/ 0200 778 724	0200/ 0520 563 607	0525 0910 281 437	0915/ 1315 208 422	1320/ 1705 151 403			1710/ 0510 538 376	0510/ 0900 289 377	0910/ 1310 247 387	1310/ 1710 574 454		1710/ 0515 103 237	0515/ 0915 57 197	0915/ 1315 60 157
Billings Downtown			0815/ 1115 2694 2694	1145/ 1545 724 1568	1545/ 1945 480 1173	1945/ 2245 460 1020	2300/ 0230 198 855	0230/ 0630 218 696	0630/ 1030 358 643	1030/ 1430 201 335	1430/ 1815 204 266	1815/ 2215 264 237		2230/ 0630 124 212	0630/ 1030 318 206		1030/ 1715 215 210			1730/ 0545 164 215			0600/ 1800 227 195		1800/ 0500 284 254		
Helena Cogswell			1000/ 1230 7889 7889	1238/ 1548 3007 5226	1558/ 1922 1963 3975	1930/ 2230 1605 3406	2232/ 0222 1115 2874	0227/ 0544 643 2503	0553/ 0958 790 2212	1000/ 1430 838 1159	1435/ 1817 329 869	1820/ 2220 282 668	2220/ 0220 265 526	0220/ 0520 196 471	0525/ 1020 546 431	1020/ 1420 1833 587	1420/ 1823 661 631	1830/ 2230 422 672	2230/ 0230 287 672	0230/ 0515 189 657	0515/ 1015 315 623	1015/ 1415 529 407	1425/ 1825 592 396	1825/ 2223 171 352	2225/ 0610 95 302		0610/ 1410 [illegible] 170
Kalispell						1345/ 2100 7366 7366		2130/ 0740 3749 5287		0930/ 1345 2767 4766	1545/ 1945 1796 3132	2015/ 2210 4483 3229		2245/ 0510 2715 2855	0540/ 1010 1176 2393	1100/ 1330 2329 2303	1340/ 1740 1503 2231	1745/ 2210 2830 2160		2210/ 0510 298 1511	0615/ 1015 135 1231		1100/ 1815 236 747			1830/ 0900 14 88	0900/ 1315 88 89
Hardin								0000/ 0630 250 250																			
Colstrip									0930/ 1130 1976 1976	1400/ 1530 514 1349		2030/ 2200 903 1215		0000/ 0515 183 687	0515/ 0940 442 402												
Scobey									0000/ 1200 1491 1491		1210/ 1700 908 1319	1705/ 2200 727 1185	2210/ 0200 765 1089	0210/ 0600 614 943	0610/ 1000 550 722	1150/ 1400 129 662	1405/ 1800 134 491	1710/ 2100 72 388		2130/ 0400 81 186	0430/ 0900 111 141		0905/ 1700 51 76		1735/ 0525 101 87		
Havre											1310/ 1800 1045 1045	1804/ 2206 365 743			2251/ 0904 629 683		1147/ 1757 190 453	1800/ 2200 255 423			2205/ 0905 438 338			1252/ 2156 662 539		2200/ 0910 65 333	
Anaconda Lincoln School							0000/ 0400 482 482		0800/ 1200 659 570		1200/ 1700 302 467	1715/ 2200 156 381	2210/ 0250 69 324														
Libby												1800/ 2200 3395 3395			2200/ 1000 616 1311	1200/ 1450 588 1213	1215/ 1720 684 630			1730/ 0530 504 557	0530/ 1725 447 475					1735/ 0720 133 272	0825/ 1320 532 268

KEY: 1530/ Sample start time
1930 Sample stop time
485 Actual reading ($\mu g/m^3$)
1280 Running 24 hour average ($\mu g/m^3$)

Table AP-I-I

MONTANA - MOUNT ST. HELENS' ASH CONCENTRATIONS

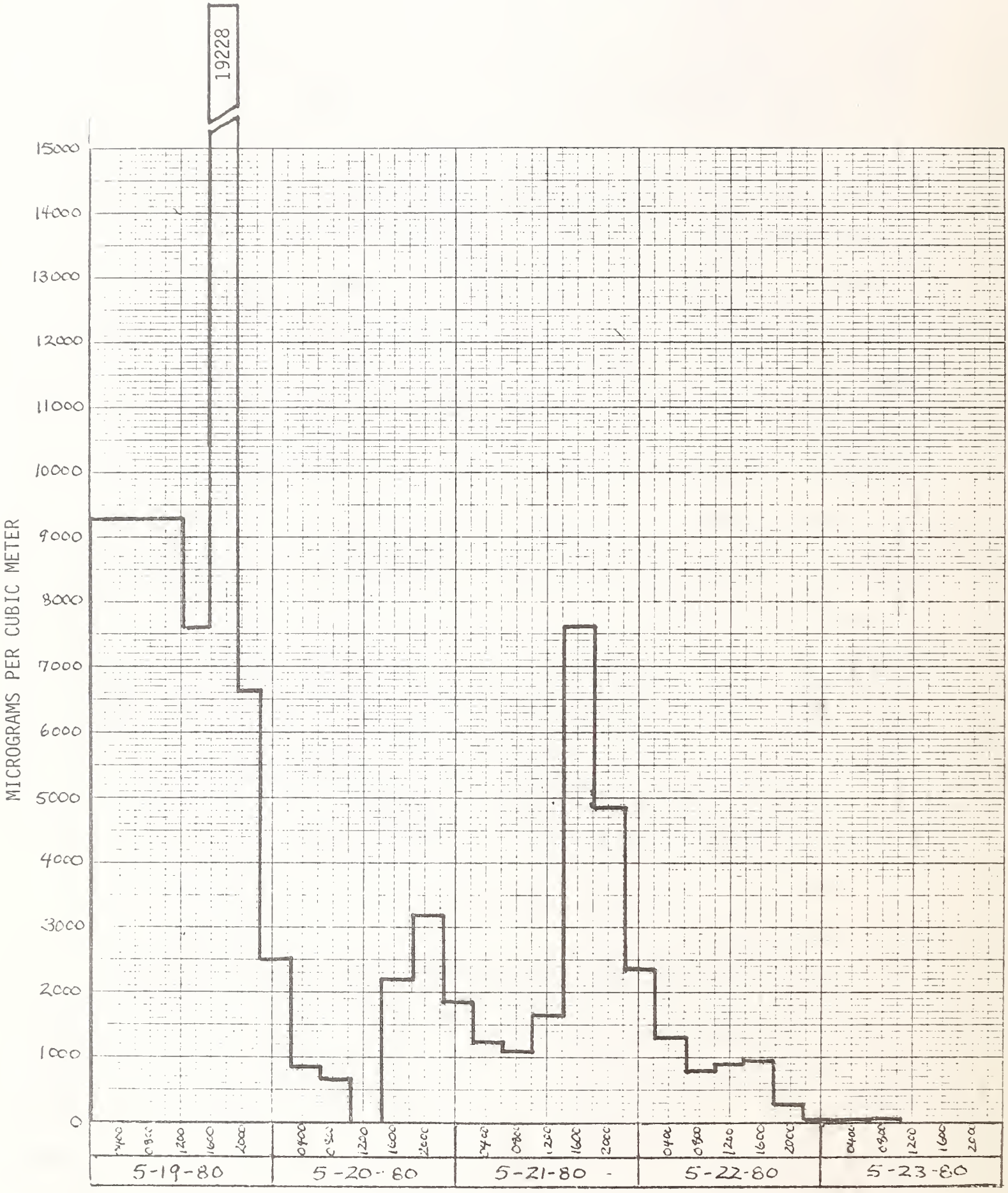


Figure AP-1-I

ASH CONCENTRATIONS IN MISSOULA
COURTHOUSE ROOF--ACTUAL READINGS

APPENDIX J

Air Quality Data Outputs

APPENDIX J

AIR QUALITY DATA OUTPUTS

This appendix has been put together to show the data user the varieties of data outputs.

The Bureau uses an adaptation of the EPA's Comprehensive Data Handling System (CDHS). This system has two subsystems: Air Quality Data Handling System (AQDHS) and Emission Inventory System/Permits and Registration (EIS/P&R).

The following outputs are generated by AQDHS, EIS/P&R, and other systems that have been programmed to our needs. They are listed as follows:

AQDHS Daily

AP-1-J Butte-Greeley School - TSP 1979
AP-2-J Kalispell - Universal Athletics - TSP 1980
AP-3-J Scobey - Border Site - TSP 1980

AQDHS Hourly

AP-4-J Anaconda - Lincoln School - SO_2 - August 1979
AP-5-J Flathead County - Airport - Wind Direction - February 1980
AP-6-J Flathead County - Airport - Wind Speed - February 1980

Upper Air Summary

AP-7-J Flathead County - Airport - 100 M Winds - September 1980

Acoustic Radar Summary

AP-8-J Billings Vo-Tech - Two Hour Stability Analysis - November 1980

TSP Plots

AP-9-J Billings - Grand Avenue School - TSP - Three Year Plot - 1978-1980
AP-10-J Columbia Falls - Anders - TSP - Three Year Plot - 1978-1980
AP-11-J Butte - Dr. Canty - TSP - One Year Plot - 1979
AP-12-J Billings Central Park - TSP - One Year Plot - 1979

CO Plot - Diurnal

AP-13-J Great Falls - GF Federal - CO (Monday-Friday) December 1980

Surface Wind Rose

AP-14-J East Helena - A&W - Monthly Wind Roses - February-May, 1980

EIS/P&R Summary Report

AP-15-J Sawmill - (Name Deleted) - Emission Estimates - Tepee Burner
Note: This report lists point sources and pollutant emission estimates from industries in the state.

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 04/04/80 — PAGE 787

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: BUTTE - GREELEY SCHOOL - HIVOL (0100-005) AGENCY: STATE (F)
PROJECT: POPULATION-ORIENTED SURV. (01) YEAR: 1979 MONTH:

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1% OF TIME
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01								83					1	83	83
02						121	73						2	97	121
03	34			62	79								3	58	79
04			71										1	71	71
05															
06									82	116			2	99	116
07								113					1	113	113
08		136				61	60						3	86	136
09	196			64	24								3	95	196
10			158										1	158	158
11												42	1	42	42
12									66	131			2	99	131
13								23					1	23	23
14		27				118	79						3	75	118
15	97			68	144								3	103	144
16			92										1	92	92
17											214	69	2	142	214
18									122	48			2	85	122
19								31					1	31	31
20		97				36	105						3	79	105
21				82	132								2	107	132
22			82										1	82	82
23											135	93	2	114	135
24									92	88			2	90	92
25								31					1	31	31
26		75				105	92						3	91	105
27				86									1	86	86
28			75										1	75	75
29											242	174	2	208	242
30									90				1	90	90
31								47					1	47	47
NO	3	4	5	5	4	5	5	6	5	4	3	4	53		
MEAN	109	84	96	72	95	88	82	55	90	96	197	95		92	
MAX	196	136	158	86	144	121	105	113	122	131	242	174			242

NUMBER OF TIMES ABOVE MONTANA VALUE: 2
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 5

GMEAN 86.42 71.89 91.30 71.75 77.48 80.07 80.31 46.14 88.62 89.50 91.11 82.75 YTD-GMEAN 79.59

Figure AP-1-J

BUTTE-GREELEY SCHOOL - TSP 1979

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 05/13/81 — PAGE 2061

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: KALISPELL - UNIVERSAL ATHLETIC - HIVOL. DICHOT (0800-015) AGENCY: STATE (F)
PROJECT: POPULATION-ORIENTED SURV. (01) YEAR: 1980 MONTH:

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1% OF TIME
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01								114					1	114	114
02						95							1	95	95
03		60		192	82								3	111	192
04															
05											83	78	2	81	83
06										130			1	130	130
07															
08					107	66	112						3	95	112
09		63		59									2	61	63
10	55												1	55	55
11											85	48	2	67	85
12									202	73			2	138	202
13								65					1	65	65
14						82	65						2	74	82
15		37		118	150								3	102	150
16	62		141										2	102	141
17												202	1	202	202
18									108	67			2	88	108
19								82					1	82	82
20		126				95	63						3	95	126
21				126									1	126	126
22															
23											148	40	2	94	148
24									117	92			2	105	117
25								71					1	71	71
26					138	68	137						3	114	138
27				87									1	87	87
28	123		197										2	160	197
29											52	296	2	174	296
30										91			1	91	91
31								72					1	72	72
NO	3	4	2	5	4	5	4	5	3	5	4	5	49		
MEAN	80	72	169	116	119	81	94	81	142	91	92	133		102	
MAX	123	126	197	192	150	95	137	114	202	130	148	296			296

NUMBER OF TIMES ABOVE MONTANA VALUE: 3
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 1
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 5

GMEAN	74.82	64.79	166.66	107.94	116.08	80.21	89.03	79.14	136.59	88.15	85.84	97.81	YTD-GMEAN	92.45

Figure AP-2-J

KALISPELL - UNIVERSAL ATHLETICS - TSP 1980

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 05/13/81 — PAGE 1255

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: DANIELS CO - SCOBEY BS#1 HIVOL,BUBBLER & CONTIN MET (0340-001) AGENCY: STATE (F)
PROJECT: BACKGROUND SURVEILLANCE (03) YEAR: 1980 MONTH:

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1% OF TIME
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01								102					1	102	102
02															
03		5		8	55								3	23	55
04	13		16										2	15	16
05											19	18	2	19	19
06									22	37			2	30	37
07								15					1	15	15
08						22							1	22	22
09		34		5	115								3	51	115
10	23		8										2	16	23
11											5	38	2	22	38
12									28	46			2	37	46
13															
14						26							1	26	26
15		10		18	63								3	30	63
16	13		10										2	12	13
17											7	66	2	37	66
18									5	5			2	5	5
19								46					1	46	46
20						21							1	21	21
21		9											1	9	9
22	7		3										2	5	7
23							116				4	18	3	46	116
24									4	14			2	9	14
25								33					1	33	33
26															
27		13		24									2	19	24
28	7		10		27								3	15	27
29											24		1	24	24
30									21	13			2	17	21
31								29					1	29	29
NO	5	5	5	4	4	3	1	5	5	5	5	4	51		
MEAN	13	14	9	14	65	23	116	45	16	23	12	35		25	
MAX	23	34	16	24	115	26	116	102	28	46	24	66			116

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

GMEAN 11.37 11.47 6.25 11.46 57.27 22.89 116.00 36.78 12.09 17.29 9.14 30.02 YTD-GMEAN 16.95

Figure AP-3-J

SCOBEY - BORDER SITE - TSP 1980

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT

REPORT DATE: 04/04/80 PAGE 10

PARAMETER: SULFUR DIOXIDE (42401) UNITS: PARTS PER MILLION (07) MIN DET: .005 DECIMAL CODE: 2
COLLECTION METHOD: INSTRUMENTAL (20) ANALYSIS METHOD: PULSED FLUORESCENT SAMPLING INTERVAL: 01 HOURS

SITE: ANACONDA LINCOLN SCHOOL #1 -HIVOL & CONTINUOUS MAPS (0020-0087) AGENCY: STATE (F)
PROJECT: POPULATION-ORIENTED SURV. (01) YEAR: 1979 MONTH: AUGUST

MONTANA STANDARD: 00.250PARTS PER MILLION-1 HR MAX-1 PER 4 DAYS
FEDERAL PRIMARY STANDARD: 00.140PARTS PER MILLION-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 00.500PARTS PER MILLION-3 HR MEAN-1 PER YEAR

DAY	HOUR 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX
01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.16	.24	.22	.14	.08	.04	.00	.00	.00	.00	.00	.00	.00	.00	.04	.24
03	.00	.00	.00	.00	.00	.01	.01	.01	.03	.03	.04	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.04
04	.00	.00	.01	.01	.04	.07	.10	.11	.20	.06	.32	.22	.00	.10	.34	.15	.06	.00	.00	.00	.18	.56	.20	.14	.14	.66
05	.08	.06	.03	.04	.03	.03	.03	.03	.10	.05	.10	.02	.00	.00	.00	.00	.00	.00	.05	.10	.05	.02	.00	.00	.04	.10
06	.01	.04	.09	.02	.01	.01	.01	.01	.11	.10	.23	.12	.01	.00	.00	.00	.00	.00	.00	.03	.28	.05	.09	.03	.04	.28
07	.01	.01	.00	.00	.01	.02	.02	.01	.02	.17	.48	.65	.43	.12	.05	.01	.02	.02	.01	.00	.00	.00	.00	.00	.09	.65
08	.03	.01	.00	.01	.02	.02	.01	.02	.03	.02	.01	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.03
09	.00	.00	.00	.00	.01	.01	.01	.01	.01	.14	.15	.11	.25	.36	.15	.02	.01	.00	.00	.00	.00	.00	.00	.00	.05	.36
10	.01	.02	.02	.02	.02	.02	.01	.02	.07	.43	.53	.31	.19	.14	.07	.02	.04	.01	.01	.00	.01	.00	.00	.00	.08	.53
11	.00	.00	.00	.00	.00	.00	.00	.02	.03	.03	.03	.03	.10	.05	.01	.00	.00	.00	.00	.07	.10	.17	.10	.03	.03	.17
12	.00	.00	.00	.00	.00	.01	.03	.05	.02	.00	.00	.01	.12	.26	.52	.08	.00	.00	.14	.05	.01	.00	.00	.00	.05	.52
13	.01	.01	.01	.01	.05	.05	.04	.03	.03	.04	.28	.37	.06	.06	.24	.15	.07	.03	.02	.02	.02	.02	.02	.02	.07	.37
14	.04	.03	.01	.01	.01	.01	.01	.01	.01	.66	1.25	1.03	.13	.13	.04	.07	.08	.26	.08	.05	.04	.04	.03	.05	.20	1.63
15	.05	.04	.04	.03	.02	.02	.02	.02	.02	.03	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.02	.05
16	.01	.02	.02	.02	.02	.02	.02	.02	.07	.16	.03	.02	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.02	.16
17	.01	.01	.01	.01	.01	.01	.02	.02	.02	.12	.49	.45	.06	.05	.03	.02	.02	.02	.05	.06	.06	.03	.02	.02	.07	.49
18	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.01	.02	.01	.04	.02	.01	.01	.01	.01	.01	.01	.01	.01	.02	.04
19	.01	.01	.01	.01	.05	.05	.04	.03	.03	.04	.28	.37	.06	.06	.24	.15	.07	.03	.02	.02	.02	.02	.02	.02	.07	.37
20	.02	.02	.02	.02	.03	.03	.03	.02	.02	.03	.03	.01	.06	.01	.01	.01	.06	.26	.09	.05	.04	.07	.05	.03	.04	.26
21	.03	.04	.03	.02	.02	.02	.02	.02	.06	.12	.54	.56	.53	.54	.05	.01	.01	.01	.01	.01	.01	.01	.01	.02	.12	.90
22	.02	.03	.06	.06	.07	.06	.05	.04	.13	.20	.44	1.01	.84	.42	.06	.10	.03	.03	.01	.02	.02	.00	.01	.01	.16	1.01
23	.01	.01	.01	.01	.01	.01	.01	.01	.03	.12	.24	.15	.12	.07	.02	.01	.14	.07	.01	.00	.00	.00	.00	.00	.04	.24
24	.00	.00	.00	.01	.01	.01	.01	.01	.01	.01	.01	.00	.00	.00	.00	.01	.00	.00	.01	.05	.38	.17	.04	.09	.03	.38
25	.02	.01	.01	.01	.02	.05	.02	.02	.04	.27	.74	.29	.06	.02	.01	.01	.01	.01	.00	.00	.00	.00	.00	.00	.07	.74
26	.01	.01	.01	.01	.02	.04	.04	.05	.04	.05	.05	.56	.23	.12	.11	.04	.01	.01	.01	.01	.01	.00	.00	.01	.06	.56
27	.01	.01	.01	.01	.11	.01	.01	.01	.01	.01	.00	.00	.00	.16	.03	.01	.01	.01	.02	.02	.02	.02	.02	.02	.02	.16
28	.02	.02	.01	.02	.02	.02	.02	.01	.01	.01	.00	.00	.00	.00	.00	.00	.01	.01	.01	.01	.00	.00	.00	.01	.01	.02
29	.07	.11	.12	.14	.17	.15	.13	.13	.17	.57	4.21	1.80	.74	.60	.14	.06	.01	.05	.08	.36	.44	.12	.08	.07	.44	4.21
30	.06	.04	.03	.02	.02	.02	.02	.02	.04	.26	.25	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.26
31	.00	.00	.00	.00	.00	.00	.00	.02	.17	.12	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.02	.17
	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	NO	
	.02	.02	.02	.02	.02	.03	.03	.03	.04	.14	.35	.30	.14	.11	.07	.03	.02	.03	.02	.03	.06	.04	.02	.02	MEAN	
	.06	.11	.12	.14	.17	.15	.13	.17	.20	.66	4.21	1.80	.84	.60	.52	.15	.14	.26	.14	.36	.44	.56	.20	.14	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 744
MONTHLY MEAN .07
MONTHLY MAX 4.21

Figure AP-4-J

ANACONDA - LINCOLN SCHOOL - SO_2 - AUGUST 1979

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 11/21/80 — PAGE 495

PARAMETER: WIND DIRECTION (61102) UNITS: DEGREES (14) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: ELECTRONIC AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET (0480-304) AGENCY: STATE (F)
PROJECT: SPECIAL STUDIES (05) YEAR: 1980 MONTH: FEBRUARY

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR																								AVG	MAX
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
01	246	89	117	302	360	154	255	335	335	276	8	43	25	186	43	192	229	66	283	34	250	251	303	163	189	360
02	198	47	164	147	148	21	304	347	15	226	92	235	215	314	240	157	115	173	172	194	131	74	215	2	164	347
03	113	212	202	221	185	220	213	229	5	263	58	189	212	257	154	153	172	202	198	236	187	150	172	166	182	263
04	134	127	156	153	178	342	313	189	164	162	166	151	140	140	150	247	247	228	235	230	216	142	326	314	202	342
05	345	355	237	345	285	48	206	329	303	298	316	320	287	318	323	169	143	168	217	147	143	186	339	3	243	355
06	154	302	232	43	324	219	152	159	237	359	339	339	56	118	158	159	220	195	221	262	348	329	37	74	210	359
07	304	331	352	262	221	164	150	172	153	11	23	184	252	92	46	137	195	161	143	147	172	342	9	242	179	352
08	207	170	129	230	220	202	147	52	282	56	258	197	144	172	292	26	332	10	325	210	356	78	35	286	184	356
09	264	11	25	333	324	80	45	58	313	323	203	105	116	164	142	134	43	143	148	173	154	137	173	184	158	333
10	14	75	76	49	204	172	157	158	207	357	3	242	279	316	311	346	37	306	229	257	287	330	346	306	211	357
11	325	4	44	334	354	339	4	27	308	344	328	354	14	14	176	213	205	330	290	323	133	348	265	259	222	354
12	122	19	245	161	314	26	360	309	286	264	36	227	18	343	75	81	115	205	252	295	321	22	17	15	172	360
13	19	23	25	26	27	21	23	21	23	23	24	31	29	25	23	23	23	23	24	25	23	20	26	38	25	38
14	32	37	23	22	26	19	15	12	13	19	15	16	15	14	336	211	219	63	17	12	14	11	10	11	49	336
15	12	16	14	18	27	22	22	24	40	16	48	125	199	192	144	136	104	107	33	353	329	25	48	22	87	353
16	1	5	22	359	354	27	44	142	153	129	162	175	186	212	197	337	182	203	170	352	71	45	290	182	167	359
17	24	289	258	9	23	185	36	307	341	161	160	204	222	189	198	173	6	167	188	118	353	18	39	309	166	353
18	324	318	349	277	221	228	154	158	48	358	6	13	9	222	184	131	149	274	265	140	195	77	247	295	193	358
19	100	142	210	184	180	160	171	167	166	172	168	160	153	153	158	163	146	203	339	342	292	241	64	331	190	342
20	349	306	356	28	78	313	106	229	170	165	160	143	146	157	156	145	153	153	156	185	238	154	281	25	181	356
21	341	315	103	315	210	35	225	33	81	272	32	331	201	190	230	117	196	278	10	359	283	255	127	243	199	359
22	319	169	306	174	328	312	102	7	216	353	33	6	289	218	176	188	206	68	315	10	344	25	326	221	196	353
23	302	312	307	284	280	301	282	281	330	330	49	154	224	209	225	201	172	190	272	71	272	24	357	255	237	357
24	328	9	291	338	283	32	299	304	292	337	324	265	227	302	253	246	97	185	227	92	297	103	91	85	221	338
25	360	68	15	154	211	189	9	11	254	277	276	167	301	212	150	142	149	324	10	45	126	227	143	298	172	360
26	314	301	236	102	17	256	234	56	234	324	155	294	69	194	170	243	27	104	285	76	297	52	29	230	179	324
27	293	149	324	36	357	260	157	350	217	76	138	357	237	26	304	98	296	310	34	336	297	91	257	272	220	357
28	121	142	330	319	331	200	77	294	345	9	3	279	356	182	303	192	155	148	178	160	155	152	143	145	197	356
29	138	158	186	186	187	163	146	157	171	165	166	144	149	157	154	155	161	28	305	79	150	303	197	279	170	305
	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	NO	
	200	155	184	187	216	162	152	170	197	211	129	188	164	182	169	170	155	173	191	182	222	145	169	181	MEAN	
	360	355	356	359	360	342	360	350	345	359	339	357	356	343	336	346	332	330	339	359	356	348	357	331	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 696
MONTHLY MEAN 178
MONTHLY MAX 360

Figure AP-5-J

FLATHEAD COUNTY - AIRPORT - WIND DIRECTION - FEBRUARY 1980

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT

REPORT DATE: 11/21/80 PAGE 489

PARAMETER: WIND SPEED (61101) UNITS: METERS PER SECOND (11) MIN DET: .36 DECIMAL CODE: 1
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: ELECTRONIC AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET (0480-304) AGENCY: STATE
PROJECT: SPECIAL STUDIES (05) (F)
YEAR: 1980 MONTH: FEBRUARY

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR																							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX
01	.2	.4	.4	.3	.3	.5	.4	.4	.6	.4	.4	.5	.3	.3	.3	.5	.5	.3	.3	.5	.7	.5	.4	.5	.4	.7
02	.7	.4	.5	.3	.4	.4	.5	.5	.9	1.0	.4	.5	.4	.3	.4	.8	.6	.4	.5	.5	.3	.5	.4	.4	.5	1.0
03	.5	.7	1.8	1.7	1.8	1.1	1.7	1.0	.5	.6	.6	1.2	1.1	1.1	2.1	2.3	2.1	1.9	2.7	1.6	1.8	2.2	2.0	2.0	1.5	2.7
04	2.4	2.4	1.4	1.9	1.4	.7	.5	.9	1.4	1.6	1.5	1.6	1.9	2.1	1.9	1.5	1.8	1.3	1.0	.9	.7	.8	.5	.8	1.4	2.4
05	.6	.9	.6	.4	.4	.3	.4	.9	1.2	1.6	1.2	1.3	1.1	1.1	.7	.3	.7	.6	.7	.3	.4	.4	.4	.7	.7	1.6
06	.1	.5	.5	.3	.3	.2	.4	.5	.3	.5	.3	.3	.3	.3	.5	.4	.4	.4	.6	.4	.2	.1	.2	.1	.3	.5
07	.3	.3	.3	.3	.5	.4	.5	.7	.5	.5	.6	.5	.5	.7	.3	.5	.5	.7	.4	.5	.5	.6	.5	.5	.5	.7
08	.5	.7	.5	.5	.3	.5	.6	.3	.4	.5	.5	.5	.4	.3	.3	.4	.5	.3	.3	.5	.3	.4	.3	.3	.4	.7
09	.2	.3	.6	.4	.4	.2	.5	.2	.5	.3	.7	.4	.4	.9	1.4	1.0	.6	.3	.6	1.0	1.6	2.0	1.2	.6	.7	2.0
10	.4	.6	.5	.4	.4	1.1	1.4	1.5	.4	.6	.8	.4	.5	.4	.4	.4	.6	.5	.5	.5	.3	.4	.5	.3	.6	1.5
11	.4	.4	.3	.4	.7	.6	.7	.6	.4	.5	.4	.7	.7	.5	.2	.4	.4	.6	.5	.5	.3	.5	.4	.3	.5	.7
12	.2	.5	.9	.7	.9	.9	.8	.4	.4	.4	.2	.1	.3	.4	.5	.5	.6	.3	.3	.4	.8	.6	2.5	3.1	.7	3.1
13	3.0	2.7	3.3	3.4	3.2	3.9	4.9	5.2	5.1	5.1	5.5	5.4	5.5	5.2	5.4	5.4	5.4	5.1	4.8	4.6	4.8	5.0	4.3	3.5	4.6	5.5
14	3.2	2.7	3.3	3.8	3.1	2.9	2.6	2.5	3.0	2.5	3.3	2.2	1.6	2.2	1.6	1.6	1.4	1.3	2.7	2.6	2.1	2.7	3.5	3.7	2.6	3.8
15	3.6	3.6	3.5	3.4	3.5	2.9	3.0	3.0	1.7	2.0	.9	.6	.6	1.0	.9	.7	.4	.3	.8	1.0	1.5	1.2	1.8	1.8	1.8	3.6
16	1.8	1.7	1.5	1.2	.6	.9	.9	.8	.6	1.2	.8	1.0	.6	.5	.6	.4	.7	.8	1.2	.9	.5	.6	.5	.6	.9	1.8
17	.3	.3	.4	.3	.4	.4	.3	.3	.3	.3	.4	.4	.6	.7	.5	.5	.4	.5	.7	.1	.3	.5	.6	.6	.4	.7
18	.6	.6	.4	.2	.4	.5	.2	.5	.5	.8	.6	.8	.8	.4	.4	.6	.2	.1	.6	.7	.5	.5	.6	.7	.5	.8
19	.5	.7	1.5	1.7	2.1	2.1	1.8	2.0	2.5	2.0	1.6	1.7	1.5	1.9	1.8	1.1	1.4	.8	1.0	1.1	1.0	.7	.6	1.1	1.4	2.5
20	1.2	1.5	1.7	.9	.8	.7	.5	.6	.9	.9	1.8	2.5	2.6	2.6	2.6	2.6	2.2	1.6	1.5	1.2	.8	.8	.7	.9	1.4	2.9
21	.8	.5	.4	.5	.4	.4	.5	.6	.4	.5	.5	.6	.6	.7	.4	.4	1.1	.3	.6	.7	.6	.3	.2	.3	.5	1.1
22	.6	.5	.5	.3	.5	.4	.5	.7	.3	.3	.4	.4	.4	.7	1.1	.9	.7	.4	.5	.9	1.0	.7	.5	.4	.6	1.1
23	.7	.6	.6	.8	.8	.8	.7	.6	.8	1.3	.9	.5	.5	.7	.6	.9	.9	1.0	.9	.5	.6	.4	.3	.4	.7	1.3
24	.3	.1	.2	.7	.3	.4	.5	.7	.5	.7	.5	.6	.4	.5	.5	.7	.4	.5	1.0	.5	.6	.5	.4	.4	.5	1.0
25	.4	.4	.5	.4	.4	.3	.4	.6	.4	.6	.3	.3	.4	.4	.6	.8	.5	.2	.4	.4	.2	.7	.7	.3	.4	.8
26	.7	.6	.5	.4	.5	.4	.4	.5	.2	.3	.6	.6	.5	.3	.4	.3	.3	.5	.4	.4	.3	.3	.5	.4	.4	.7
27	.4	.7	.6	.7	.4	.7	.5	.6	.4	.5	.4	.5	.3	.4	.5	.4	.5	.7	.6	1.2	.8	.8	.4	.7	.6	1.2
28	.6	.4	.7	.8	1.0	.7	1.0	1.6	1.5	1.3	2.7	1.6	1.7	1.2	.7	1.2	1.9	2.5	1.6	1.4	1.6	2.0	2.5	2.7	1.5	2.7
29	2.5	1.9	1.5	1.8	1.6	1.9	2.6	2.1	1.4	1.4	1.2	1.5	1.7	1.6	2.1	1.7	1.1	.8	.9	.3	.3	.5	.5	.4	1.4	2.6
	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	NO	
	1.0	1.0	1.0	1.0	1.0	.9	1.0	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.9	1.0	.9	.9	1.0	.9	1.0	MEAN	
	3.6	3.6	3.5	3.8	3.5	3.9	4.9	5.2	5.1	5.1	5.5	5.4	5.5	5.2	5.4	5.4	5.4	5.1	4.8	4.6	4.8	5.0	4.3	3.7	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NUR READINGS 696
MONTHLY MEAN 1.0
MONTHLY MAX 5.5

Figure AP-6-J

FLATHEAD COUNTY - AIRPORT - WIND SPEED - FEBRUARY 1980

FREQUENCY SUMMARY OF UPPER LEVEL WINDS (PERCENTAGES)

LOCATION: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET

100 METER LEVEL WINDS MORNING SEPTEMBER,1980

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW SUMMARY		
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N			5.5				1	5.5	7.0
NNE	5.5						1	5.5	.5
NE							0	0.0	
ENE		5.5					1	5.5	5.2
E							0	0.0	
ESE	11.1		5.5				3	16.6	3.0
SE			5.5	5.5			2	11.0	8.2
SSE	5.5						1	5.5	2.6
S							0	0.0	
SSW		5.5					1	5.5	5.4
SW							0	0.0	
WSW							0	0.0	
W		5.5					1	5.5	3.7
WNW	5.5	11.1	5.5				4	22.1	5.4
NW							0	0.0	
NNW	5.5	5.5	5.5				3	16.5	5.3
CALM							0	0.0	
COL. TOTALS	33.1	33.1	27.5	5.5			18		4.8

100 METER LEVEL WINDS AFTERNOON SEPTEMBER,1980

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW SUMMARY		
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N							0	0.0	
NNE							0	0.0	
NE							0	0.0	
ENE		11.1					1	11.1	4.1
E	11.1						1	11.1	1.3
ESE							0	0.0	
SE		11.1					1	11.1	3.1
SSE	11.1						1	11.1	2.4
S							0	0.0	
SSW							0	0.0	
SW		11.1					1	11.1	3.4
WSW							0	0.0	
W	22.2	11.1					3	33.3	2.0
WNW	11.1						1	11.1	2.9
NW							0	0.0	
NNW							0	0.0	
CALM							0	0.0	
COL. TOTALS	55.5	44.4					9		2.5

Figure AP-7-J

FLATHEAD COUNTY - AIRPORT - 100 M WINDS - SEPTEMBER 1980

ACOUSTIC RADAR ANALYSIS

MONTANA AIR POLLUTION STUDY - BILLINGS MONTH OF NOVEMBER 1980

********* TWO HOUR STABILITY ANALYSIS **********

DAY	HOUR 02	04	06	08	10	12	14	16	18	20	22	24
1	E	E	E	E	E	D	C	D	D	E	E	E
2	E	E	E	E	E	D	D	C	D	D	E	E
3	E	E	E	E	E	D	C	C	D	D	E	E
4	E	E	E	E	E	D	D	D	D	D	E	E
5	E	E	E	E	E	D	C	C	D	E	E	E
6	E	E	E	E	E	E	D	C	D	D	E	E
7	E	E	E	E	E	D	C	C	D	E	E	E
8	E	E	E	E	D	D	D	D	D	E	E	E
9	E	E	E	E	E	D	C	C	D	D	F	F
10	E	E	E	E	E	D	C	C	D	D	E	E
11	E	E	E	E	D	C	C	C	D	D	D	D
12	D	D	D	D	D	D	D	D	D	D	D	E
13	E	E	E	D	C	C	E	D	D	D	D	E
14	E	E	E	E	D	C	C	D	D	E	E	E
15	E	E	E	E	D	C	C	D	D	E	E	E
16	E	E	E	E	D	C	C	D	D	E	E	E
17	E	E	E	E	D	C	C	D	D	E	E	E
18	E	E	E	E	D	C	C	D	D	E	E	E
19	E	E	E	E	D	C	C	D	D	E	E	E
20	E	E	E	E	D	C	C	D	D	E	E	E
21	E	E	E	E	D	D	D	D	D	E	E	E
22	E	E	E	D	D	D	C	C	D	D	F	F
23	F	E	E	E	D	C	C	C	D	E	F	F
24	E	E	E	E	E	E	C	C	D	E	E	E
25	E	E	E	D	C	C	D	D	D	E	E	E
26	E	E	E	D	C	C	C	D	D	E	E	E
27	E	E	E	E	D	D	D	D	D	D	E	E
28	E	E	E	D	C	D	D	D	D	E	E	E
29	E	E	E	E	E	E	D	D	D	E	E	E
30	E	E	E	D	D	C	C	D	D	D	D	D

PERCENT FREQUENCY OF OCCURENCE FOR EACH CATEGORY

A= 0.0 % B= 0.3 % C=13.1 % D=32.5 % E=52.2 % F= 1.9 %

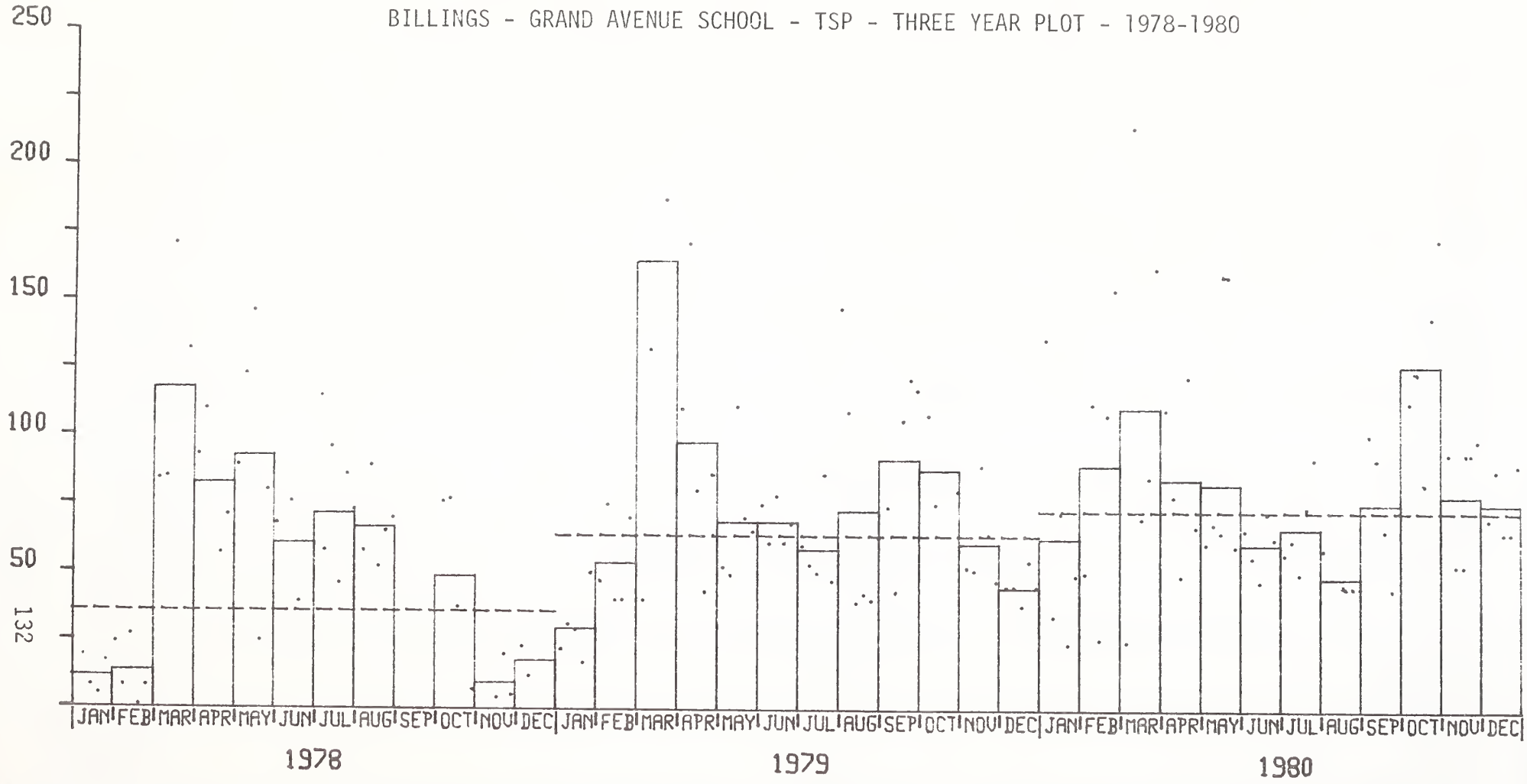
U= 0.0 % M= 0.0 %

Figure AP-8-J

BILLINGS VO-TECH - TWO HOUR STABILITY ANALYSIS - NOVEMBER 1980

Figure AP-9-J

BILLINGS - GRAND AVENUE SCHOOL - TSP - THREE YEAR PLOT - 1978-1980



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM OBS	5	5	4	4	5	3	5	5		4	3	2	5	5	4	5	5	5	5	6	5	3	5	5	5	5	5	5	5	5	4	4	5	5	5
MO.AVG	12	14	118	83	93	61	72	67		49	10	18	30	54	165	98	69	69	59	73	92	88	61	45	63	90	111	85	83	61	67	49	76	127	79	76
GEO.AVG	36												64												73											

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0080, BILLINGS
SITE. . . . . 009, GRAND AVE SCHOOL
CITY. . . . . BILLINGS

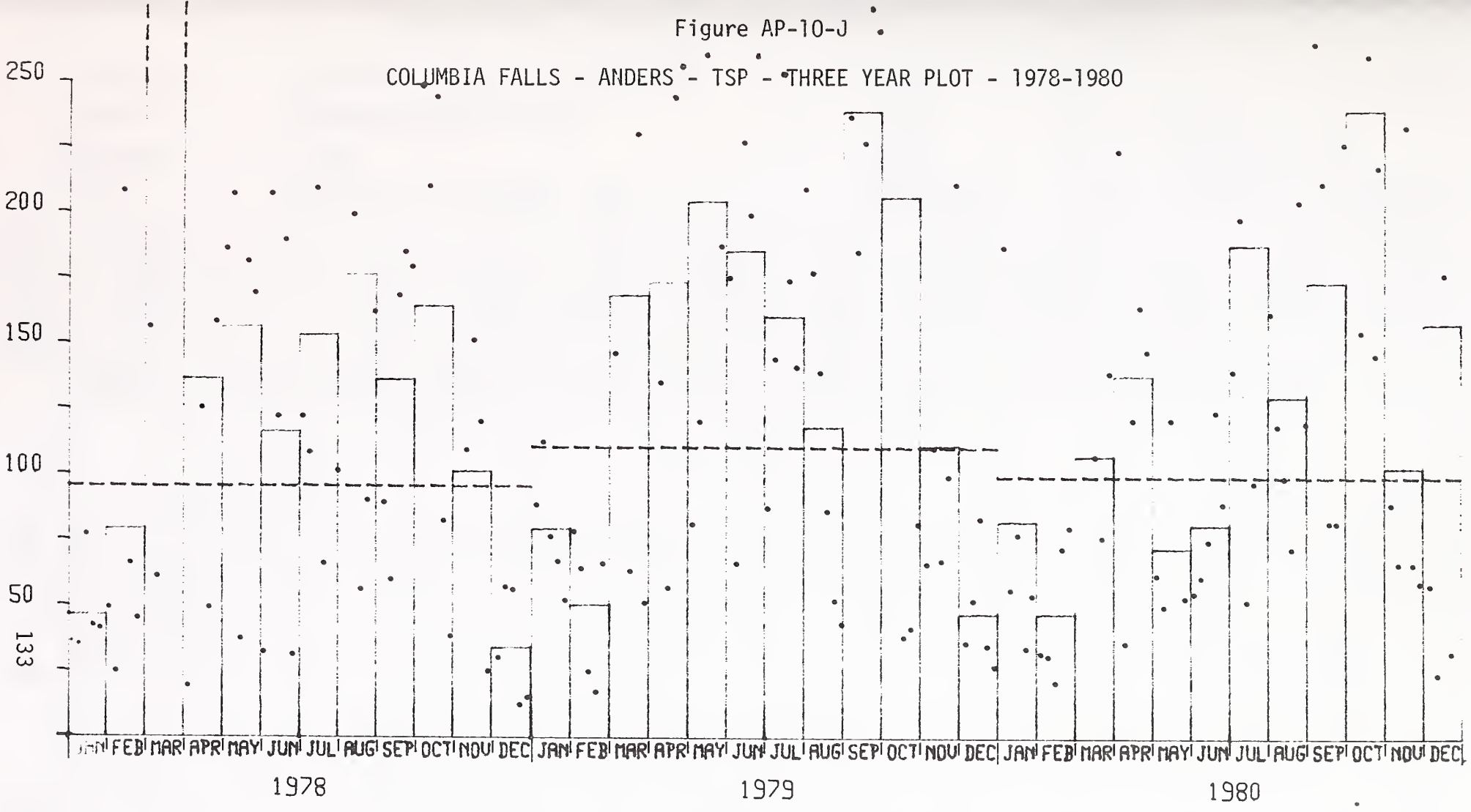
MONTANA STATE AIR QUALITY BUREAU

MARCH 31,1981

TECHNICAL SERVICES

Figure AP-10-J

COLUMBIA FALLS - ANDERS - TSP - THREE YEAR PLOT - 1978-1980



NUM OBS	5	5	5	5	5	5	6	5	5	5	4	5	5	5	5	4	5	5	5	6	5	5	5	5	5	5	3	5	4	5	5	6	5	5	5	5
MO.AVG	47	80	292	137	157	117	154	177	137	165	102	35	80	51	169	174	205	186	161	119	240	207	112	48	83	48	108	139	73	82	189	131	175	241	104	159
GEO.AVG	96												111												100											

PLOT. . . . . CONCENTRATION VERSUS TIME

METHOD . . . . . HI VOL

UNITS . . . . . MICROGRAMS/CUBIC METER

STANDARDS (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES

AREA. . . . . 0270, FLATHEAD CO

SITE. . . . . 005, ANDERS RESIDENCE

CITY. . . . . COLUMBIA FALS

MONTANA STATE AIR QUALITY BUREAU

MARCH 31, 1981

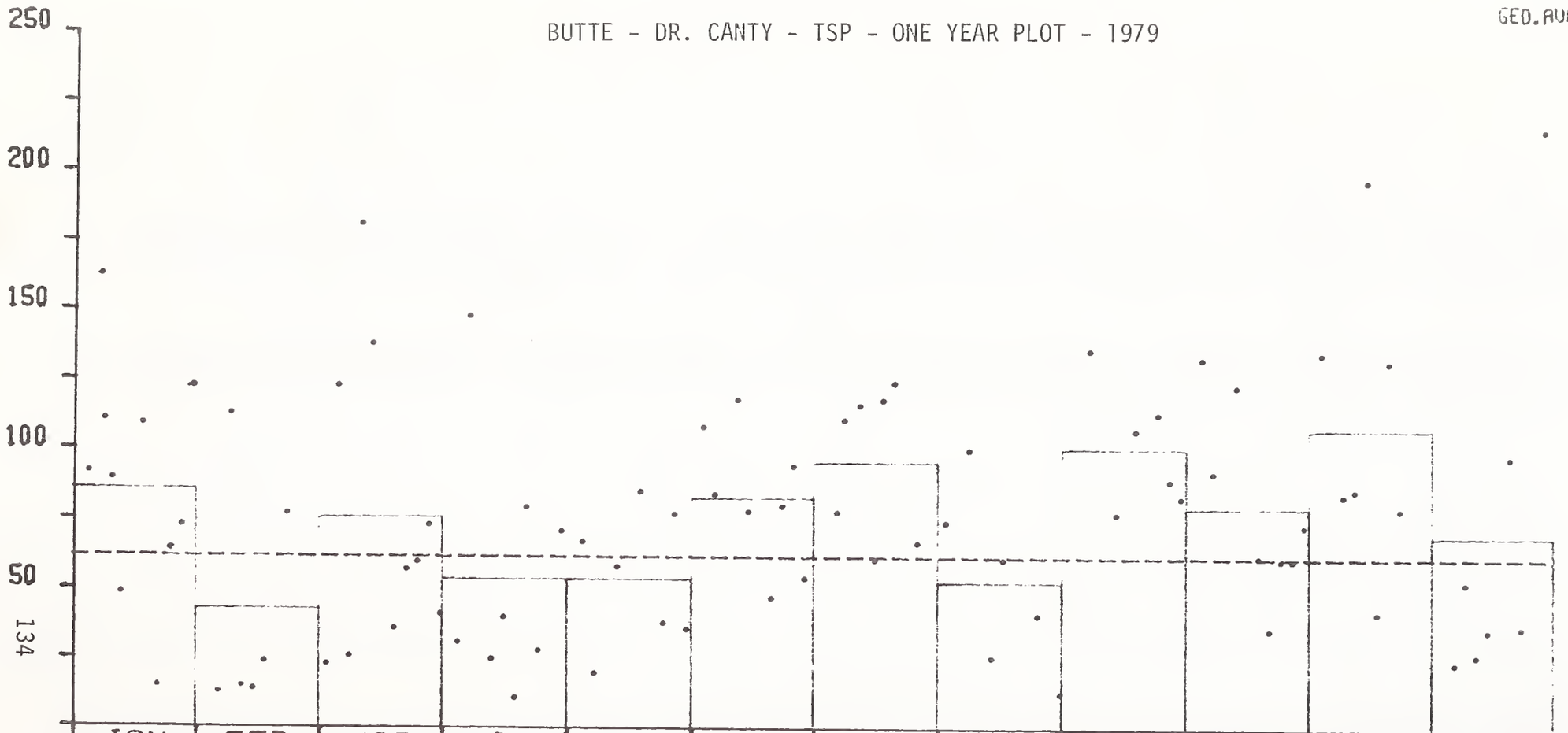
TECHNICAL SERVICES

Figure AP-11-J

1979

GEO.AUG = 62

BUTTE - DR. CANTY - TSP - ONE YEAR PLOT - 1979



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	9	6	10	8	7	8	7	6	6	8	7	7
1-HIGH	163	113	181	148	85	118	124	100	136	133	197	216
2-HIGH	122	77	138	79	77	108	118	74	113	123	135	98
NO.AVG	86	43	76	54	54	83	96	53	101	80	108	70

PLOT. . . . . CONCENTRATION VERSUS TIME

METHOD . . . . . HI VOL

UNITS . . . . . MICROGRAMS/CUBIC METER

STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES

AREA. . . . . 0160, SILVER BOW CO

SITE. . . . . 019, D. CANTY

CITY. . . . . BUTTE

MONTANA STATE AIR QUALITY BUREAU

MARCH 31,1981

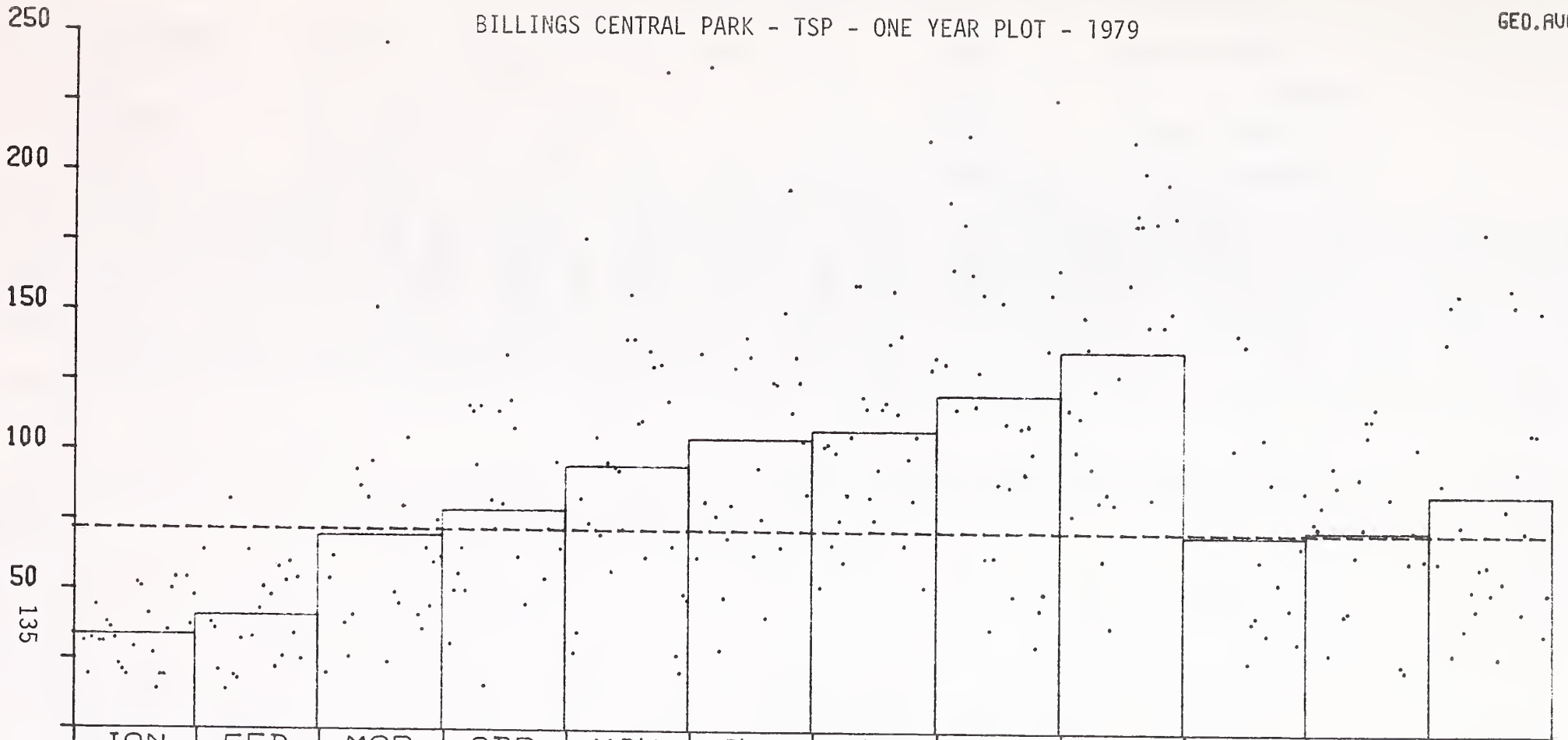
TECHNICAL SERVICES

Figure AP-12-J

1979

BILLINGS CENTRAL PARK - TSP - ONE YEAR PLOT - 1979

GEO.AUG = 72



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	27	22	24	23	28	26	30	28	27	15	23	26
1-HIGH	54	82	246	134	236	238	212	227	266	143	117	180
2-HIGH	54	64	151	118	176	194	160	214	212	139	113	160
MO.AUG	34	41	70	79	95	105	108	121	137	71	73	86

PLOT. . . . . CONCENTRATION VERSUS TIME

METHOD . . . . . HI VOL

UNITS . . . . . MICROGRAMS/CUBIC METER

STANDARDS . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES

AREA. . . . . 0080, BILLINGS

SITE. . . . . 059, CENTRAL PARK EAST

CITY. . . . . BILLINGS

MONTANA STATE AIR QUALITY BUREAU

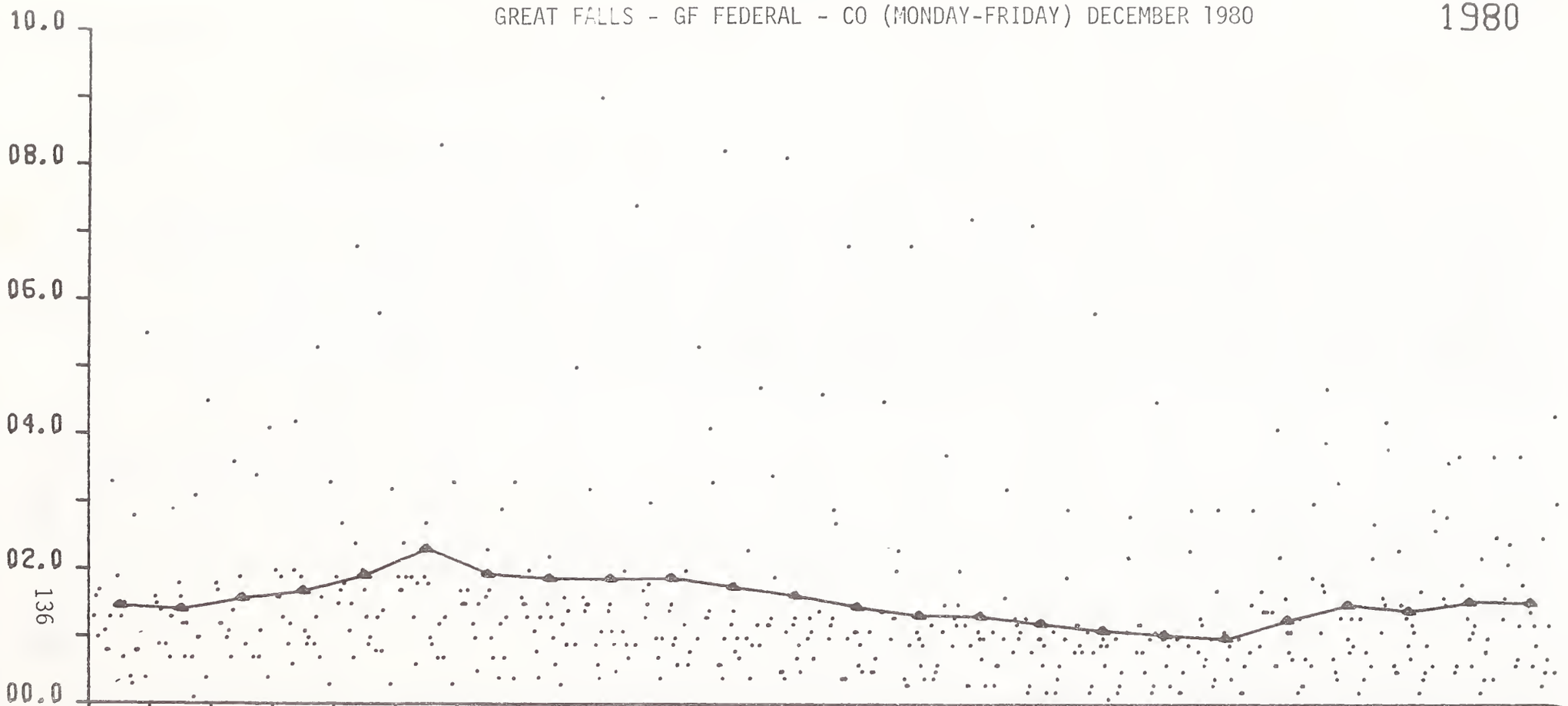
MARCH 31,1981

TECHNICAL SERVICES

Figure AP-13-J

DECEMBER
1980

GREAT FALLS - GF FEDERAL - CO (MONDAY-FRIDAY) DECEMBER 1980



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	21	20	18	22	22	22	22	22	21	21	22	21	22	22	22	22	22	22	22	23	22	23	21	22
1-HIGH	5.50	4.50	4.10	5.30	6.80	11.8	13.3	12.2	9.00	11.2	8.20	8.10	6.80	6.80	7.20	7.10	5.80	4.50	2.90	4.10	4.70	4.20	3.70	4.30
2-HIGH	3.30	3.10	3.60	4.20	5.80	8.30	3.30	5.00	7.40	5.30	4.70	4.60	4.50	3.70	3.20	2.90	2.80	2.90	2.90	3.00	3.90	3.80	3.70	3.70
HR.AVG	1.46	1.42	1.58	1.69	1.93	2.32	1.95	1.89	1.88	1.90	1.75	1.63	1.47	1.34	1.33	1.22	1.12	1.06	1.00	1.27	1.50	1.41	1.54	1.54

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-FRI)
METHOD . . . . . NON-DISPERSIVE INFARED
UNITS . . . . . PARTS PER MILLION
STANDARDS . . . (FEDERAL) 9 PPM 8-HR / 35 PPM 1-HR

PARAMETER . . CARBON MONOXIDE
AREA. . . . . 0660, CASCADE CO
SITE. . . . . 021, GF FEDERAL
CITY. . . . . GREAT FALLS

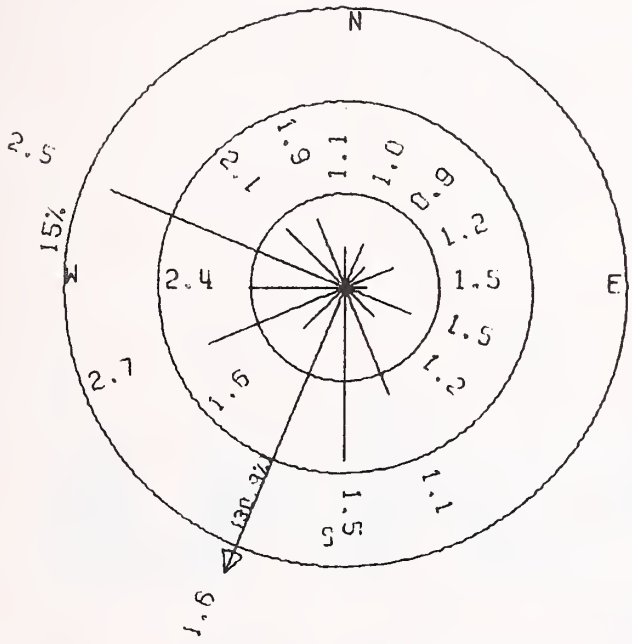
MONTANA STATE AIR QUALITY BUREAU

MARCH 31, 1981

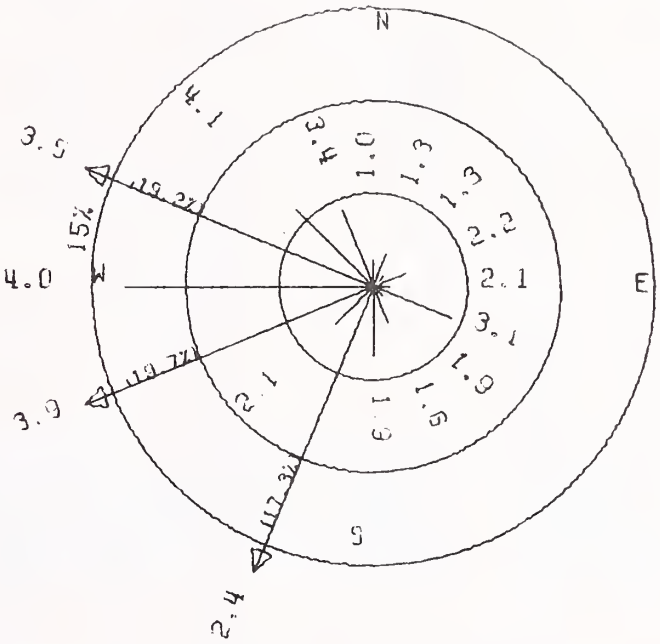
TECHNICAL SERVICES

SURFACE WIND ROSES

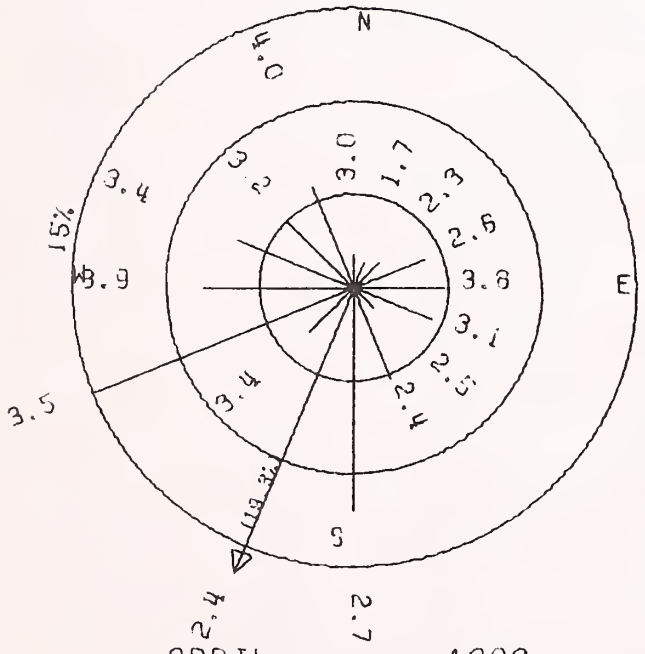
SITE: 660008 EAST HELENA A & W
EAST HELENA MONTANA



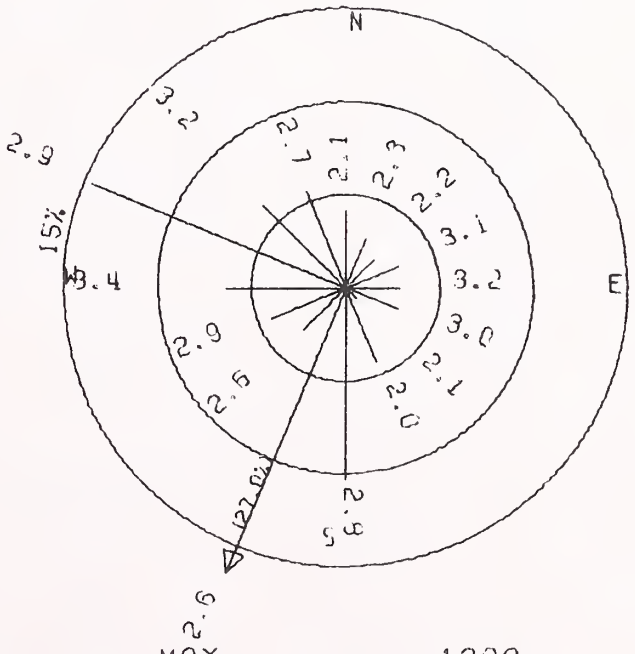
FEBRUARY 1980
HOURS 0 TO 23
CALM 0.1%
(TOTAL HOURS 691)



MARCH 1980
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 709)



APRIL 1980
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 692)



MAY 1980
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 634)

Figure AP-14-J

EAST HELENA - A&W - MONTHLY WIND ROSES - FEBRUARY-MAY, 1980

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
POINT SOURCE MASTER DETAIL LIST REPORT DATE: 04/28/81 PAGE: 278

COUNTY: LAKE 0620 AQCR: MISSOULA 144 PLANT ID: 0002

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	CONTROL REGION	LOCAL CONTROL	USER PLANT ID	CITY	UTM ZONE	OWNER	CONTACT	TELEPHONE	PRINCIPAL PRODUCT	NUMBER OF EMPLOYEES
000	79	03/80					11	P			LUMBER	0170

ESTABLISHMENT NAME AND ADDRESS ZIP MAILING ADDRESS ZIP PROPERTY AREA - ACRES

00250.0

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	POINT ID NEDS	USER	SIC	TPP	UTM COORDINATES-KM HORIZ	VERT	LATITUDE DEG MIN SEC	LONGITUDE DEG MIN SEC	% ANNUAL THRUPUT DEC MAR	JUN SEP	NORMAL OPERATING HR/D	D/WK	WK/YR
101	79	12/80	01		2421		716.5	5277.2			25 25	25 25	16	5	51

BOILER CAPACITY MM BTU	% SPACE HEAT	STACK DATA HEIGHT FEET	DIAM FEET	TEMP DEG F	FLOW RATE CU FT/MIN	VELOCITY FT/MIN	NBR OF POINTS	PLUME HT FEET	COMPLIANCE STAT	SCHED YR MO	STAT DATE	ECAP	CONTROL REGULATION REG1	REG2	REG3
00000	00.0	0070	05.0	0900	0013883	00014		0000	2			0	4030		

NBR OF POLLUTS	POLLUTANT ID	CONTROL COST THOUS $$	CNTL EQUIP PRI	CNTL EQUIP SEC	% ESTIM CONTROL EFFICNCY	EMISSIONS TONS/YEAR UNCONTROLLED	EMISSIONS TONS/YEAR ESTIMATED ALLOWABLE	ESTIM METH	TEST METH	EMISS UNITS
05	NITROGEN DIOXIDE		000	000	00.0	0000008	0000008	3		
	SULFUR DIOXIDE		000	000	00.0	0000001	0000001	3		
	SUSPENDED PARTICULATE		000	000	00.0	0000054	0000054	3		
	CARBON MONOXIDE		000	000	00.0	0000996	0000996	3		
	HYDROCARBON		000	000	00.0	0000084	0000084	3		

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	SCC 1	SCC II	SCC III	SCC IV	FUEL PROCESS RATE	MAX DESIGN RATE-HOURLY	% SULPHUR CONTENT	% ASH CONTENT	HEAT CONTENT MM BTU	CONFID CODE	SOURCE CODE	BEC NBR	FUEL ID	UNITS
2 01 05	79	12/80	5	03	001	05	0015316	0014.100	0.00	1.20	00009	2	C			

SOURCE DESCRIPTION	EMIS FACTOR SOURCE	NBR OF EMIS FACTORS	POLLUTANT ID	EMISSION FACTOR	ASH/SULPHUR CODE	FACTOR UNITS
CONICAL WOOD WASTE BURNER	A	05	SUSPENDED PARTICULATE	000007.000		
			CARBON MONOXIDE	000130.000		
			SULFUR DIOXIDE	000000.100		
			NITROGEN DIOXIDE	000001.000		
			HYDROCARBON	000011.000		

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	LINE NBR	COMMENTS
3 01 11	79	12/80	001	THIS TEPEE BURNER IS EQUIPPED WITH A LAUSMAN INCINERATOR SYSTEM.

Figure AP-15-J

SAWMILL - EMISSION ESTIMATES - TEPEE BURNER

APPENDIX K

Smoke Management

APPENDIX K

SMOKE MANAGEMENT

The Smoke Management Plan was devised by the State Airshed Group to coordinate burning operations on all forest and rangeland in the state. The State Airshed Group consists of representatives from the following agencies and forest products industries.

Air Quality Bureau
U. S. Forest Service
Bureau of Land Management
St. Regis Paper Company
National Weather Service
Glacier National Park
Yellowstone National Park
Missoula City-County Air Pollution Control Board
Bureau of Indian Affairs
Montana Division of Forestry
Burlington Northern, Inc.
Champion International
Mont. Dept. of Fish, Wildife & Parks
Wicks Forest Industries
U. S. Dept. of Fish and Wildlife

During the autumn months, a two-man monitoring unit is set up at the Montana Division of Forestry Office in Missoula. This unit gathers meteorological information daily and has the authority to issue burning restrictions on days forecast for poor ventilation. Restrictions are issued only for those areas predicted to experience inversions or poor dispersion. The map on the following page (Figure AP-1-K) shows the ten designated airsheds in Montana. The success of this plan involves the cooperative effort of all organizations involved in the use of prescribed burning for disposal of slash and other accepted land management practices.

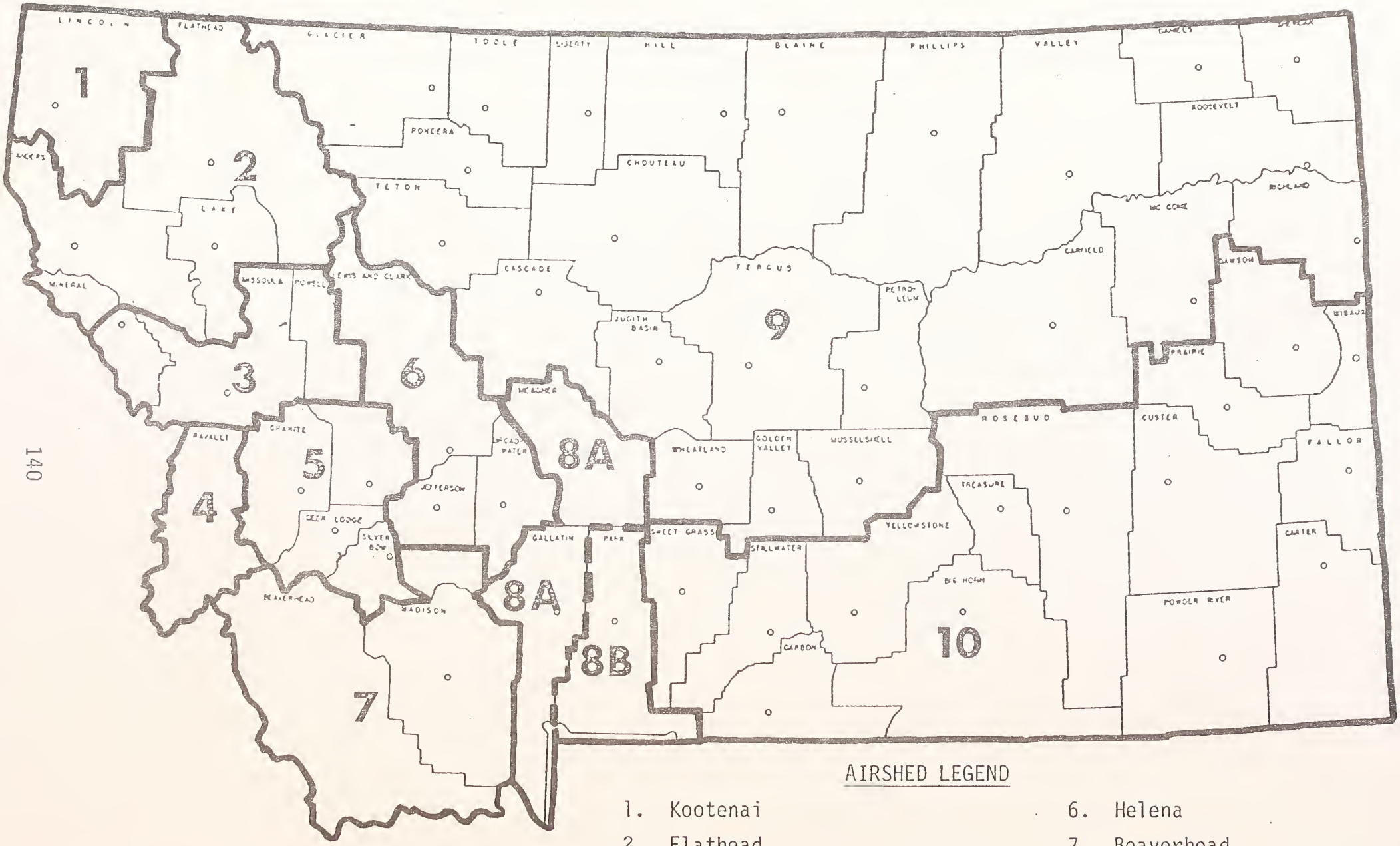


Figure AP-1-K

MONTANA SMOKE MANAGEMENT AIRSHEDS

AIRSHED LEGEND

1. Kootenai
2. Flathead
3. Blackfoot-Clark Fork
4. Bitterroot
5. Upper Clark Fork
6. Helena
7. Beaverhead
8. A. Gallatin
   B. Park
9. Missouri
10. Yellowstone

APPENDIX L

Hi-vol Schedules

APPENDIX L

HI-VOL SCHEDULES

High volume samplers (hi-vols) are usually operated on a one-in-six day schedule. In order to meet the needs of data collectors or hi-vol operators, hi-vol schedules for 1981 and 1982 are presented on the following pages.

Figure AP-1-L

1981

1981 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
4	3	5
10	9	11
16	15	17
22	21	23
28	27	29

QUARTER 2

April -	May -	June -
4	4	3
10	10	9
16	16	15
22	22	21
28	28	27

QUARTER 3

July -	August -	Sept. -
3	2	1
9	8	7
15	14	13
21	20	19
27	26	25

QUARTER 4

October -	November -	December-
1	6	6
7	12	12
13	18	18
19	24	24
25	30	30
31		

January - (1982)
5
11
17
23
29

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

Figure AP-2-L

1982

1982 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
5	4	6
11	10	12
17	16	18
23	22	24
29	28	30

QUARTER 2

April -	May -	June -
5	5	4
11	11	10
17	17	16
23	23	22
29	29	28

QUARTER 3

July -	August -	Sept. -
4	3	2
10	9	8
16	15	14
22	21	20
28	27	26

QUARTER 4

October -	November -	December
2	1	1
8	7	7
14	13	13
20	19	19
26	25	25
		31

January - (1983)
6
12
18
24
30

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

APPENDIX M

List of Air Quality Rules

APPENDIX M

LIST OF AIR QUALITY RULES

This appendix provides a list of the Montana Air Quality Rules. As mandated by the Clean Air Act of Montana, the Board of Health and Environmental Sciences adopted the rules through a review and hearings procedure. It is the Department's business to administer and enforce the rules. Upon request, a copy of these rules can be obtained from the Air Quality Bureau.

HEALTH AND ENVIRONMENTAL SCIENCES

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AIR QUALITY

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APPENDIX N

Visible Emission Documentation

APPENDIX N

VISIBLE EMISSION DOCUMENTATION

Visible emission documentation on a pollution source is performed by a trained observer in the field. A pollution source may be a tepee burner, asphalt plant, boiler, power plant or any stack or emission point that might exhibit a plume.

Visible emissions are taken by the observer in five percent increments of opacity. Opacity is defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

All point sources have opacity limitations. These are listed in the air quality rules. The opacity standards range from 10 to 40 percent and depend on the type and age of the source.

In order for a person to become a trained observer, he or she must attend a visible emissions documentation course or "smoke school." The Air Quality Bureau offers a smoke school twice each year, usually in April and October. The observer must attend a lecture session and pass a field session in order to pass smoke school.

The lecture section includes the following topics:

Definition of opacity

Composition of Plumes

Meteorological aspect of Plumes

Smoke Generator

Method 9 Certification Procedures and Field Documentation

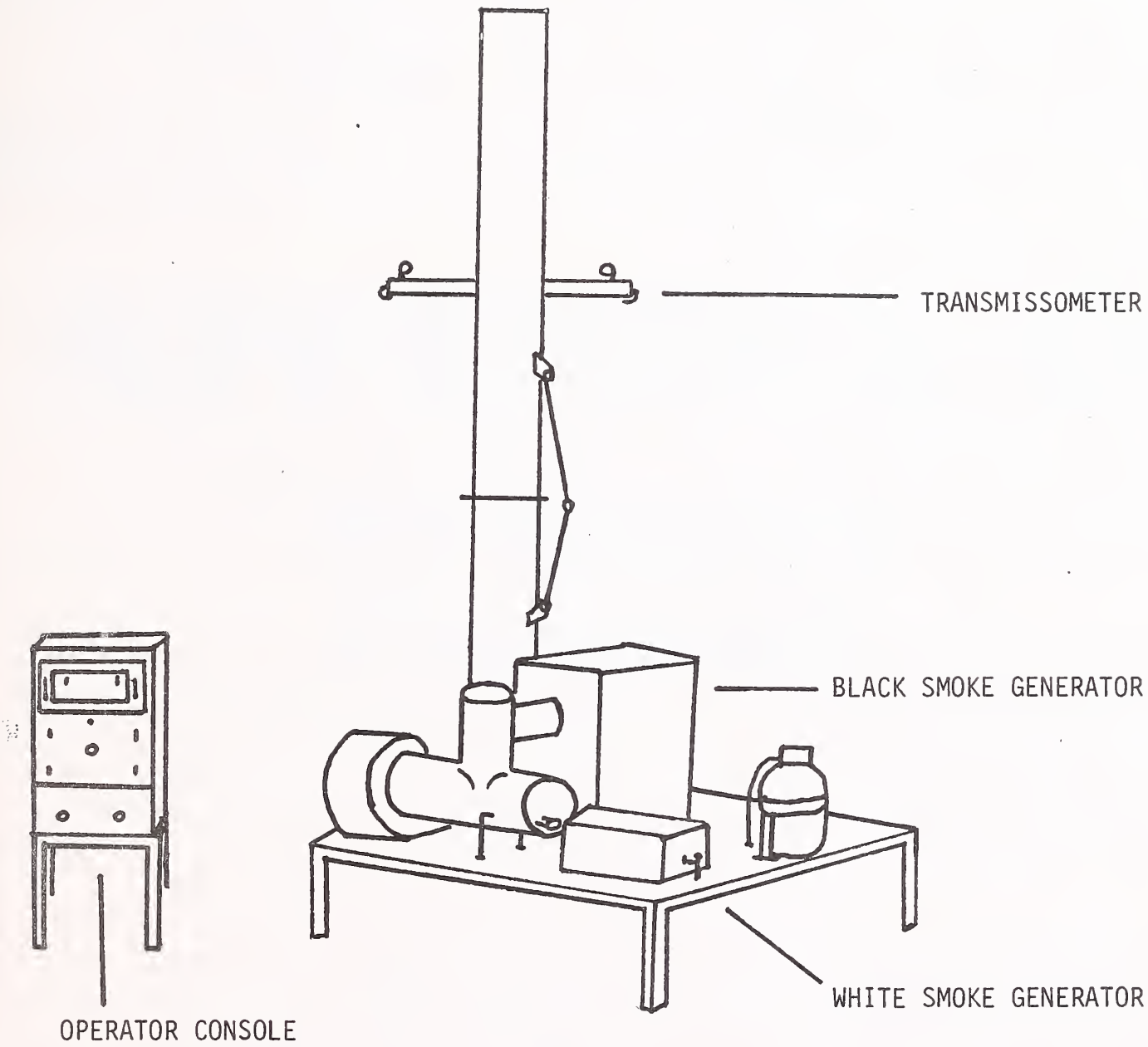
Opacity Regulations

Legal Aspects of Opacity

During the field portion, the observer reads the opacity of 25 black and 25 white smoke plumes produced by a smoke generator. Observed opacities are compared with measured opacities (transmissometer readings) and a certain degree of accuracy is needed to pass.

After a person passes smoke school, the qualified observer can read opacity of a plume in the field. A plume must be read for six minutes, taking 24 readings every 15 seconds. Care must be taken not to read a steam plume if one exists.

A drawing of the smoke generator (Figure AP-1-N) and a visible emission documentation form (Figure AP-2-N) are copied on the following pages.



ENVIRONMENTAL INDUSTRIES

MODEL 3000

SMOKE GENERATOR

Figure AP-1-N

MONTANA STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

VISIBLE EMISSIONS FIELD DOCUMENTATION

FIRM NAME _____ DATE _____
ADDRESS _____ START TIME _____
BUSINESS _____ STOP TIME _____
DESCRIPTION OF SOURCE _____ OBSERVER _____
_____ OBSERVATION POINT _____
TYPE OF FUEL _____
STACK HEIGHT _____ STACK DIAMETER _____
DISTANCE FROM STACK _____
DIRECTION FROM STACK _____
GENERAL PLUME CHARACTERISTICS (COLOR, ETC.) _____
_____

☐ RESPONSE TO COMPLAINT
☐ ROUTINE INSPECTION
☐ OBSERVATION
☐ SPECIAL INVESTIGATION

GENERAL METEOROLOGY: SKY CONDITIONS AND COLOR _____ EST. AMBIENT
AIR TEMP. _____ EST. WIND SPEED _____ DIRECTION _____ EST. RELATIVE HUMIDITY _____

PLUME DENSITY READINGS: IN OPACITY

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

OTHER REMARKS _____

AVERAGE PLUME DENSITY OPACITY _____ TOTAL MINUTES IN VIOLATION _____

IF VIOLATION NOTED, PERSON CONTACTED _____ DATE _____ TIME _____

Figure AP-2-N

VISIBLE EMISSION DOCUMENTATION FORM

APPENDIX O

Air Quality Personnel

APPENDIX O

AIR QUALITY PERSONNEL
1979-1980

Air Quality Bureau

(406)449-3454

Harold Robbins, Chief (1980-present)
*Mike Roach, Chief (1975-1980)
Dean Arthun
*Marv Bauer
*Jon Bolstad
John Coefield
Henry Custin
Patricia Davidson
Pat Driscoll
*Vic Garrett
*Dennis Haddow
*Lew Hammermeister
Judee Holst
Charles Homer
Jim Hughes
Harry Keltz
*Mike Machler
David Maughan
Warren Norton
Jim Olsen
Jerry Preszler
Bob Raisch
Jerry Schneider
Stan Sternberg
Maureen Stohl
Cynthia Wevers
*JoAnn Vorozilchak

Cascade County Air Pollution Control

(406)761-1190

Sam Kalafat
William Nielsen
Bruce Treis

Missoula City-County Health Department

(406)721-5700

Roland Samel
Jim Carlson
Scott Church

Yellowstone County Air Pollution Control

(406)252-0756

Steve Duganz
Russ Boschee

*No longer employed by the Air Quality Bureau

APPENDIX P

Air Monitoring Equipment

APPENDIX P

Air Monitoring Equipment

This appendix is intended to give the data and information user a brief description of how air monitoring equipment works. Most of the information contained in this appendix was taken from the Air Quality Bureau's Quality Assurance Handbook.

Table AP-P-I gives a summary of the various pollutants and their analytical procedure.

Table AP-P-I

Pollutants and Analytical Procedures

Analyte	Procedure
Total Suspended Particulate	Filter Impaction/Gravimetric Analysis
Respirable Particulates	Operation/Dichotomous or Virtual Sampler
Particulates	Beta Attenuation
Carbon Monoxide	Non-dispersive Infrared
Lead	Atomic Absorption Spectrophotometry
Hydrogen sulfide and sulfur dioxide	Gas chromatography and flame photometric detection
Sulfur Dioxide	Pulsed fluorescence
Nitrogen oxides	Chemiluminescence
Ozone	Ultraviolet photometry
Hydrocarbons	Flame Ionization
Gaseous and particulate fluorides	Bicarbonate tube
Fluoride	Dual tape sampler

Analyte: Total Suspended Particulates (TSP)

Procedure: Filter impaction/gravimetric analysis

General Information:

Particulate matter is collected by a high volume sampler (hi-vol) by pulling a known volume of air through a preweighed glass fibre filter. As the air is pulled through the filter, particulate matter that is suspended in the air is impacted onto the filter material. After the sampler has run for 24 hours, the filter is reweighed (usually in a laboratory). The weight of the particulate matter (grams) on the filter is divided by the volume of air (cubic meters (m^3)) to give a concentration in micrograms per cubic meter (ug/m^3).

The hi-vol is constructed of aluminum in the shape of a box (dimensions 16" x 16" x 48") with a pitched roof. The interior contains a "vacuum cleaner" type electric motor, a filter holder, a flow measuring device(s), and a timer. The samplers usually run on a one-in-six day schedule but may be run more frequently if necessary.

A laboratory type balance is used to weigh the filter. The balance needs to be accurate to one tenth of a milligram (0.1 mg) or one ten thousandth of a gram. There are 453.6 grams in a pound.

Analyte: Particulates

Procedures: Beta attenuation

General Information:

This analyzer measures concentrations of airborne particulates, integrated over preprogrammed time intervals, by the process of beta ray attenuation. Samples are collected on strips of glass fiber tape. Before the sample is collected, the tape is positioned between a beta ray source (C^{14}) and a geiger counter. The beta ray count taken through the tape is used as a blank value. Sample is deposited on the tape by a constant flow of ambient air. The sample and tape are again situated between the source and counter. This second count will be lower than the first count because the sample will absorb some of the beta rays in excess to the amount of x-rays absorbed by the tape itself. The difference in beta ray counts between the tape and the tape plus sample is log proportional to the amount of sample on the tape. After calculating, the sample mass, it is divided by the total airflow over the sample collection period. This gives an integrated particulate concentration for that sample period. All calculations are done internally by the analyzer with a microprocessor. Sample times as low as 3 minutes or as great as 999 minutes can be programmed by the user.

Analyte: Respirable and Inhalable Particulates

Procedure: Operation, Dichotomous or Virtual Impactor

General Information:

The dichotmous sampler is designed to sample for particulates of two size ranges: 1) those particles less than 2.5 microns (aerodynamic diameter), and 2) those particles greater than 2.5 microns and less than 15 microns. Two 37 millimeter diameter filters collect the particulate, one filter for each size range. The filters are weighed before and after each run to determine the mass loading on each filter. Concentration is then calculated from the measured air flow. Two rotometers are installed on the sampler to measure the flows during the run.

This type of instrument is divided into two sections: the sampling module and the control module. The sampling module contains the sampling head separation device, and the two filters. The control module contains the air pump, flow controller, rotameters, and the clock mechanism. The two units are connected by polypropylene tubing.

The sampling module is the portion where the actual separation and collection of each particle size is accommplished. The particles larger than 15 microns are eliminated at the round sampling head. A bug screen is placed in the sampling head to keep out insects and to collect particles larger than 15 microns. The particles less than 15 microns proceed down the sampling tube to the nozzle. The nozzle accelerates the particles and forces the majority of air (approximately 90%) to make a sharp 90° turn in a very short distance. This 90° turn is the principle on which the separation is based. Any heavy particle (i.e. any particle greater than 2.5 microns) will not be able to make this sudden turn. These particles will be drawn down into the coarse particles tube which is located straight below the nozzle. The other particles (less than 2.5 microns) will make the 90° turn and will be drawn down the fine particle tube. At the bottom of both tubes are the appropriate filters. The air flow is drawn from the control module through the 3/8" (fine) and 1/4" (coarse) lines.

Analyte: Lead

Procedure: Atomic Absorption Spectrophotometry

General Information

Lead is sampled in the field using a standard hi-volume air sampler. This sampler pulls a large volume of air through a glass fiber filter. The filter is then mailed or hand carried from the field site to the Air Quality Bureau where the sample is logged in. The volume of the air sample is calculated and then it is transferred to the laboratory for analysis. The filter is equilabrated and weighed for total suspended particulate. Then a portion of the filter is extracted using an acidic solution to solubilize the lead on the filter. The resulting solution is analyzed using atomic absorption spectrophotometry to determine the amount of lead present.

Analyte: Sulfur Dioxide

Procedures: Pulsed fluorescence

General Information

The sample airstream is exposed to a pulsating ultraviolet light, which electromagnetically excites sulfur dioxide in the air sample. The excited SO_2 quickly decays to its ground state emitting a photon of fluorescent light, whose intensity is measured by a photomultiplier tube. The wavelength of excitation light entering the detection chamber and the wavelength of fluorescent light entering the photomultiplier tube both are carefully controlled by narrow bandpass filters, which reduce interference from other fluorescent species in the sample gas. The light is pulsed for six reasons: long UV lamp life, high intensity UV without lamp heating, small lamp size for UV output, low lamp power requirements, long term UV stability, and chopped signal processing (alternatively measuring signal and photomultiplier dark current). After the photomultiplier dark current is subtracted from the fluorescent SO_2 signal, the signal output is directly proportional to the concentration of SO_2 in the sample gas.

Analyte: Hydrogen sulfide and sulfur dioxide

Procedures: Gas chromatography and flame photometric detection

General Information:

Ambient air entering the analyzer is separated into two fragments by a gas chromatographic column, one part containing any sulfur dioxide present in the sample and the second component consisting of any hydrogen sulfide. The amount of sulfur atoms in each fragment is detected by a flame photometer. This detection principle consists of burning the sample in a hydrogen rich flame, which produces the excited reduced species S_2. The S_2 decays to ground state emitting a photon near 390nm. This photon is sensed by a photomultiplier tube. Because the measured molecule is a sulfur dimer, the photomultiplier output (picoamps) is nonlinear with respect to ambient sulfur concentrations. The output is approximately to the 1.8 power of the ambient concentration. Deviation from the theoretical second power is due to quenching of the excited species. The photomultiplier output is linearized by a set of logarithmeic amplifiers. The rest of the analyzer consists of flow control devices and temperature controllers for the detector oven and column.

Analyte: Nitrogen Oxides

Procedures: Chemiluminescent reaction of NO and O_3

General Information:

The analyzer utilizes a chemiluminescent reaction between nitric oxide and ozone to quantitatively determine the concentration of nitrogen oxides in the sample air. Ozone, produced in excess by ultraviolet irradiation of dried air, is reacted with any nitric oxide in the sample air and the resultant chemiluminescent photons are measured with a photomultiplier proportional to the amount of nitric oxide in the sample. A second portion of sample air is routed through a converter which changes all the NO_2 in the sample air to nitric oxide. This gas is reacted in another reaction chamber with the ozone and gives a measurement proportional to the total amount of nitrogen oxides in the sample. Thus, there are two parallel reaction chambers determining the nitric oxide concentration and the total nitrogen oxides concentration. These signals are electronically subtracted to give a nitrogen dioxide concentration.

Analyte: Ozone

Procedures: Ultraviolet photometry

General Information:

This analyzer works on the principle of absorption of ultraviolet light in the 254nm band by ozone. The principle is similar to an ultraviolet spectrophotometer with a 71cm folded gas cell. A sample of ambient air, selectively scrubbed of ozone, is injected into the cell. The attenuation of ultraviolet light without ozone is determined by a light sensitive diode. The sample cell is flushed and a new sample of air containing ambient levels of ozone is measured for ultraviolet absorption. The sample air without ozone is a reference cell measurement. The difference between the reference measurement and the sample with ozone measurement determines the ultraviolet absorption attributable only to the ozone. This absorption is proportional to the ozone concentration by the Beer-Lambert law. Since only a single detection cell is used in the instrument, ambient air and ozone-scrubbed ambient air are sequentially cycled through the cell. This cycle time is between 20 and 30 seconds. This means that the analyzer will not give correct values in situations in which the ozone concentration changes significantly in 30 seconds. This usually does not present a problem in enforcement monitoring but may be significant in low level research near point sources.

Analyte: Carbon Monoxide

Procedures: Non-dispersive Infrared

General Information:

The (carbon monoxide) analyzer measures continuous amounts of carbon monoxide from 0-50 to 0-1000 ppm full scale deflection. The detector operates on an infrared absorption principle.

The analyzer detects carbon monoxide from the absorption of infrared radiation. Nondispersive infrared radiation is introduced to the detector with a double-beam arrangement. The infrared beams pass through two cells: (1) a sealed reference cell filled with a non-absorbing gas, and (2) a sample cell through which the sample air containing the carbon monoxide is continuously drawn.

The Infrared Gas Analyzer utilizes the measurement principle based on CO having a known characteristic absorption spectra in the infrared range. The analyzer contains an infrared detector that uses the nondispersive single beam technique with alternate modulation of the sample and reference cells. The reference cell is filled with a nonabsorbing gas and sealed, and the sample is routed through the sample cell. With no CO present in the sample, the amounts of radiation coupled into the detector from the sample and reference cells will be essentially equal, effectively canceling in the detector and producing no output. When CO is present in the sample, some radiation is absorbed by the CO, causing the detector inputs to be unequal, and producing a capacitance change in the detector. The detector is so designed that the amount of capacitance change in the detector is equivalent to a known amount of CO. The infrared radiation is chopped by an optical chopper to cause a periodic capacitance change, which modulates a radio frequency signal from an oscillator. This signal is subsequently demodulated, amplified, and the output is fed to the front panel meter as well as to a strip chart recorder.

Analyte: Reactive Hydrocarbons

Procedures: Flame Ionization

General Information:

The hydrocarbon analyzer measures semicontinuous amounts of total hydrocarbons (THC) and non-methane hydrocarbons (NMH) simultaneously from a 0 to 10 ppm to a 0 to 50 ppm full scale deflection. At the same time the instrument measures semicontinuous amounts of methane from a 0 to 2 ppm to a 0 to 10 ppm full scale deflection. The detector operates on a flame ionization principle.

Measured volumes of air are delivered semi-continuously (18 times per hour) to a hydrogen flame (the detector area). Basically, the detector area consists of a burner (jet), a collector (an electrical plate), and an oxygen rich atmosphere with a supply of hydrogen to keep a small flame. Any hydrocarbons present in the sample will be burned causing an electrical current flow from the burner tip to the collector by way of the flame. The amount of current flow (ionization) is proportinal to the concentration of the hydrocarbons. The electrical signal is amplified to give a meter and a recorder output for total hydrocarbons. An aliquot of the same air sample is introduced into a stripper column which removes water, carbon dioxide, and hydrocarbons other than methane (gas chromatograph principle). The methane is then introduced to the detector where the response is recorded. The methane value is electronically subtracted from the total hydrocarbon value to obtain the reactive hydrocarbon or the non-methane value.

Control and division of the sample is accomplished by a flow system consisting of an air supply, solenoid valves, and switching valves. Flow rates and overall timing mechanisms must be precisely controlled in the analyzer.

The response to all three variables may be monitored simultaneously by three recorders or by a single multipoint recorder.

Analyte: Fluoride

Procedures: Dual paper tape collection of HF and particulates

General Information:

Sample air is drawn through the inlet tube and down through two paper tapes. The first tape is treated with citric acid and functions as a collector for particulates. The citric acid prevents the first tape from reacting with and absorbing gaseous hydrogen fluoride. The second tape is treated with sodium hydroxide and recovers better than 95 percent of the hydrogen floride at sampling times of 15 to 120 minutes with fluoride loads up to 40 ug/m^3. The sample air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is used to pressurize the cabinet containing the sample tape rolls, thus preventing unwanted fluoride contamination of the tape by the instrument's operating environment. At preprogrammed time intervals the sampler shuts off the sample pump, indexes the tape and then samples a new section of tape. Approximately 600 samples can be collected on each tape set. The sample spots are cut out of the tape and subjected to one of the standard acceptable methods of fluoride analysis.

Analyte: Gaseous and particulate fluorides

Procedure: Bicarbonate tube

General Information:

Sample air is drawn through a glass tube which has sodium bicarbonate coated on the inner wall of the tube. The bicarbonate removes gaseous fluorides from the sample stream. A filter at the end of the tube captures the particulates from the sample. After the normal sampling interval (usually 24 hours), the sample flow is stopped. The filter is retained for analysis of particulate fluorides. The bicarbonate is washed out of the tube and analyzed for fluoride content. Recovery of gaseous HF is about 95% up until saturation of the tube at 500 ug F. Sample air which is high in acids (SO_2, NO_2, O_3 and hydrocarbons, at 50% or greater relative humidity) will react with the bicarbonate in the tube and reduce collection efficiency and total fluoride holding capacity. The lower detectable limit of the method is a function of the quality of the bicarbonate used for coating the tubes. Bicarbonate containing significant fluoride contamination will not have the low level resolution of fluoride free bicarbonate. The minimum detectable limit is determined as two standard deviations of the mean of the blank values. The blanks come from sample tubes which have been prepared for sampling but are maintained unexposed.

APPENDIX Q

Air Quality Data Inputs

APPENDIX Q

AIR QUALITY DATA INPUT

Agencies and companies often need to input their air monitoring data to the state's computer system (AQDHS). This appendix is a brief summary of the various data forms and magnetic tape requirements for inputting data.

Figures AP-1-Q through AP-4-Q show four input forms used for hourly, daily, and monthly data. Forms 2179 and BAC are used for daily (24-hour) data while form BAQ is generally used for monthly data. The SAROAD form is used only for hourly data. Brief instructions for forms 2179 and SAROAD follow the figures. Some parameter codes are listed.

Agencies and companies may input their data on magnetic tapes. The data must be of the same format as the beforementioned input forms. Tape requirements are as follows:

Standard IBM label (if labeled)

Prefer Non-labeled (NL)

9-track tape

800, 1600, 6250 BPI's (specified)

80 characters

Any blocking size (specified)

EBSIDIC

SAROAD on one file only

BAC, BAQ, 2179 one file only

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

Date Received: _____

Analyst: _____

Date Completed: _____

	2	7
1	2	3

HV Mem. Dichot.

Parameter	Parameter	Parameter	Parameter
23 24 25 26 27	37 38 39 40 41	51 52 53 54 55	65 66 67 68 69

Method Units DP	Method Units DP	Method Units DP	Method Units DP
28 29 30 31 32	42 43 44 45 46	56 57 58 59 60	70 71 72 73 74

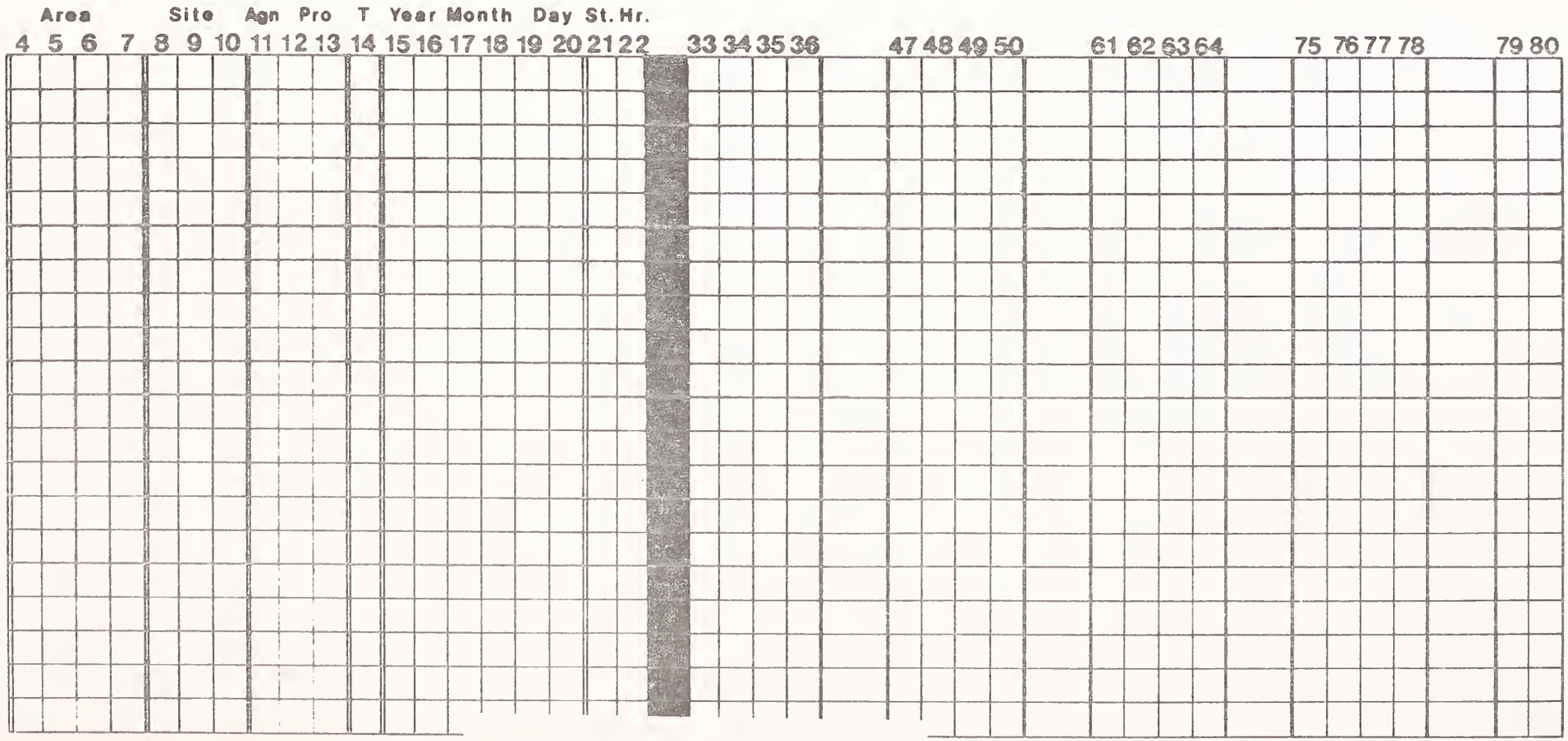


Figure AP-1-Q

Form: 2179 Comments:

DATA INPUT FORM - 2179

MONTANA STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
Helena, Montana

State	Agency	Project	Time	Year	Period (month)	Number of Spls.	Comp Spl. Type Time
2 3	11	12 13	14	15 16	17 18	19 20	21 22

2

Area Address

Collected By

Date Received Date Reported

Analyst

Comments or unusual activities:

Name PARAMETER Code	Name PARAMETER Code	Name PARAMETER Code	Name PARAMETER Code
23 24 25 26 27	37 38 39 40 41	51 52 53 54 55	65 66 67 68 69
Method Units DP	Method Units DP	Method Units DP	Method Units DP
28 29 30 31 32	42 43 44 45 46	56 57 58 59 60	70 71 72 73 74
4 3 2 1 0	4 3 2 1 0	4 3 2 1 0	4 3 2 1 0

Lab. No.	Sample No.	Location and Description	Date Out	Date In	Sampling Period	Area 4 5 6 7	Site 8 9 10	33 34 35 36	47 48 49 50	61 62 63 64	75 76 77 78

STATE DEPARTMENT OF HEALTH

AND ENVIRONMENTAL SCIENCES

HELENA, MONTANA

24-HOUR OR GREATER SAMPLING INTERVAL

2

1 Agency

City Name

Site Address

Project

Time Interval

State Area Site

2 3 4 5 6 7 8 9 10

Agency Pro. T. Year Month

11 12 13 14 15 16 17 18

TSP Name PARAMETER Code

23 24 25 26 27 Method Units DP

28 29 30 31 32

Org Name PARAMETER Code

37 38 39 40 41 Method Units DP

42 43 44 45 46

As Name PARAMETER Code

51 52 53 54 55 Method Units DP

56 57 58 59 60

Pb Name PARAMETER Code

65 66 67 68 69 Method Units DP

70 71 72 73 74

Cd Name PARAMETER Code

23 24 25 26 27 Method Units DP

28 29 30 31 32

Zn Name PARAMETER Code

37 38 39 40 41 Method Units DP

42 43 44 45 46

$SO_4^=$ Name PARAMETER Code

51 52 53 54 55 Method Units DP

56 57 58 59 60

Name PARAMETER Code

65 66 67 68 69 Method Units DP

70 71 72 73 74

Collection Day 19 20	Lab. No.	Filter No.	Date Sample Logged	Operator	Total Volume Air (M^3)	Unusual Circumstance *	Day 19 20 21 22	33 34 35 36	47 48 49 50	61 62 63 64	75 76 77 78	Day 19 20	33 34 35 36	47 48 49 50	61 62 63 64	75 76 77 78
0 1							0 1					0 1				
0 2							0 2					0 2				
0 3							0 3					0 3				
0 4							0 4					0 4				
0 5							0 5					0 5				
0 6							0 6					0 6				
0 7							0 7					0 7				
0 8							0 8					0 8				
0 9							0 9					0 9				
1 0							1 0					1 0				
1 1							1 1					1 1				
1 2							1 2					1 2				
1 3							1 3					1 3				
1 4							1 4					1 4				
1 5							1 5					1 5				
1 6							1 6					1 6				
1 7							1 7					1 7				
1 8							1 8					1 8				
1 9							1 9					1 9				
2 0							2 0					2 0				
2 1							2 1					2 1				
2 2							2 2					2 2				
2 3							2 3					2 3				
2 4							2 4					2 4				
2 5							2 5					2 5				
2 6							2 6					2 6				
2 7							2 7					2 7				
2 8							2 8					2 8				
2 9							2 9					2 9				
3 0							3 0					3 0				
3 1							3 1					3 1				

DP → 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0

168

Comments or unusual circumstances

* codes 0 = excess of 24 hr. 5 = dry
1 = approx. 72°F 6 = clear
2 = approx. 32°F 7 = hazy
3 = rain 8 = calm
4 = snow 9 = windy

BAQ
3/72

Figure AP-3-Q

DATA INPUT FORM - BAQ

LESS THAN 24-HOUR SAMPLING INTERVAL

1 (1) Agency

AIR QUALITY BUREAU

State (2 3) Area (4 5 6 7) Site (8 9 10): 2 7

City Name

Site Address

Project

Parameter observed

Method

Time interval of obs.

Units of obs.

Agency (11) | Project (12 13) | Time (14) | Year (15 16) | Month (17 18)

Parameter code (23 24 25 26 27) | Method (28 29) | Units (30 31) | DP (32)

Day (19 20)	St Hr (21 22)	Rdg 1 (33 34 35 36)	Rdg 2 (37 38 39 40)	Rdg 3 (41 42 43 44)	Rdg 4 (45 46 47 48)	Rdg 5 (49 50 51 52)	Rdg 6 (53 54 55 56)	Rdg 7 (57 58 59 60)	Rdg 8 (61 62 63 64)	Rdg 9 (65 66 67 68)	Rdg 10 (69 70 71 72)	Rdg 11 (73 74 75 76)	Rdg 12 (77 78 79 80)
01	00												
01	12												
02	00												
02	12												
03	00												
03	12												
04	00												
04	12												
05	00												
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13	12												
14	00												
14	12												
15	00												
15	12												
16	00												

Figure AP-4-Q

DATA INPUT FORM - SAROAD

FORM 2179

Col 1	Will always be coded 2, which indicates a 24-hour sample
Col 4-10	Area and site codes (different for each site, supplied by AQB)
Col 11	Agency code = J (indicates company, other letters indicates agencies)
Col 12,13	Project code = 02 (or 07 if sampler is colocated)
Col 14	Time code = 8
Col 15 - 20	Year, Month, Day the sample was run (YY,MM,DD)
Col 21, 22	Start hour = 00 (for all TSP readings)
Col 23 - 27	Parameter code = 11101 for TSP
Col 28,29	Method code = 91 for TSP
Col 30,31	Unit code = 01 for TSP
Col 32	Decimal code = 0 or 1 depending on analysis - but be consistent
Col 33-36	data
Col 37-46	Additional parameters
Col 47-50	space for data for parameter in Col 37-46, and so on
Col 80	always coded 2 to indicate new data

If a sample is void, write comments to the left of Col 4 - never write comments in the numered areas reserved for data.

SAROAD FORMS

These forms are numbered according to the days of the month. They are completed similarly to 2179 with these exceptions:

Col 14	Time code - 1 for hourly data
Col 23-32	Parameter, method, unit, decimal depending on monitoring equipment. See Parameter Code Description Table
Col 33-80	Data (for negative numbers contact AQB for correct procedure)

PARAMETER CODE DESCRIPTION TABLE

Parameter	Code	Method	Units	Decimal	Method Description
TSP	11101	91	01	0 or 1	Gravimetric
Wind Speed	61101	50	11	1	Electronic Avg-meters/second
	61101	40	12	1	Visual Avg-miles per hour
Wind Direction	61102	50	14	0	Electronic Avg-degrees
	61102	40	14	0	Visual avg-degrees
Wind Deviation	61106	50	14	0	Electronic Avg-degrees
Wind Peak	61110	50	11	0	Electronic-meters/second
	61110	40	12	1	Hourly peak-miles per hour
Temperature	62101	50	17	1	Electronic Avg-^{o}Centigrade
	62101	40	15	1	Machine Avg- ^{o}Farenheit
Dew Point	62103	50	17	1	Electronic Avg-^{o}C
	62103	40	15	1	Visual Ave-^{o}F
Barometric Pr	64101	11	16	1	Aneroid - millibars
	64101	11	22	1	Aneroid - inches mercury

APPENDIX R

Acronyms and Abbreviations

APPENDIX R

ACRONYMS AND ABBREVIATIONS

AA	Atomic absorption spectrophotometry
ACFM	actual cubic feet per minute
ADP	automatic data processing
APCA	Air Pollution Control Association
APRAC	Urban diffusion model for CO
AQB	Air Quality Bureau
AQCR	Air quality control region
AQDHS	Air Quality Data Handling System
AQDM	Air Quality Display Model
AQMA	Air Quality Maintenance Area
ARM	Administrative Rules of Montana
As	arsenic
ASTM	American Society for Testing Materials
BACT	Best Available Control Technology
B(a)P	Benzo-(a)-pyrene
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CALINE	California Line Model for CO
Cd	Cadmium
CDHS	Comprehensive Data Handling System
CDM	Climatological Dispersion Model
CEMS	Continuous Emission Monitoring System
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CRM	Certified Reference Material
CRSTER	Single Source meteorological model
Cu	Copper
DAS	Data aquisition system
DHES	Department of Health & Environmental Sciences
DHS	Data Handling System
DNRC	Department of Natural Resources and Conservation
DSCF	Dry standard cubic feet
DSL	Department of State Lands
EA	Environmental Assessment
EIC	Environmental Information Center
EIS	Environmental Impact Statement
EIS/P&R	Emission Inventory System/Permits and Registration
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Council
ESD	Environmental Sciences Division
ESP	Electrostatic Precipitator
ES&T	Environmental Science and Technology

F Fluorine (fluoride)
FAA Federal Aviation Administration
FBC Fluidized bed combustion
FGD Flue gas desulfurization
FID Flame ionization detector
FPD Flame photometric detector

G or (g) Grams
GC Gas chromatography
GR or (gr) Grains

HC Hydrocarbons
HF Hydrofluoric acid
HIWAY Meteorological model for CO
HPLC High performance liquid chromatography
H_2O Oxide of hydrogen
H_2S Hydrogen sulfide
H_2SO_4 Sulfuric Acid

ICP Inductively Coupled Plasma
I/M Inspection and maintenance
IP Inhalable particulates
ISC Industrial Source Complex model

JAPCA Journal of Air Pollution Control Association

LAER Lowest achieveable emission rate

M Meter
M^3 Cubic meters
MAAQS Montana Ambient Air Quality Standards Study
MAPS Montana Air Pollution Study
MCA Montana Codes Annotated
MCAA Montana Clean Air Act
MEPA Montana Environmental Policy Act
MHD Magnetohydrodynamics
MS Mass Spectrometry
MCCHD Missoula City-County Health Department
MO Montana Office (EPA)
Mu micron

NA Neutron Activation or Nonattainment
NAAQS National Ambient Air Quality Standards
NADB National Aerometric Data Bank
NADP National Atmospheric Deposition Program
NAMS National Air Monitoring Station
NBS National Bureau of Standards

NDIR	Nondispersive Infrared Analysis
NEDS	National Emission Data System
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
Ni	Nickel
NMHC	Non methane hydrocarbons
NMR	Nuclear magnetic resonance
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of Nitrogens
NO_2	Nitrogen dioxide
NO_3	Nitrate
NPRC	Northern Plains Resource Council
NSPS	New source performance standards
NTIS	National Technical Information Service
NWS	National Weather Sevice
O	Oxygen atom
O_2	Oxygen molecule
O_3	Ozone
PAL	Point, area and line source air quality model
Pb	Lead
PBL	Planetary boundary layer
PER	Preliminary Environmental Review
PM	Preventive Maintenance
PNA	Polynuclear aromatic hydrocarbon
POM	Polycyclic organic matter
PPM	Parts per million
PSD	Prevention of Significant Deterioration
PSI	Pollutant standards index or pounds per square inch
PTDIS	Single stack meteorological model
PTMAX	Single stack meteorological model
PTMTP	Multistack meteorological model
P&A	Precision and accuracy
QA	Quality Assurance
RACT	Reasonably available control technology
RAM	Urban air model for point and area sources
RP	Respirable particulates
S	Sulfur
SAMWG	Standing Air Monitoring Work Group
SAROAD	Storage and retrieval of aerometric data
SI	International system of units
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur dioxide
SO_4	Sulfate
SPM	Special purpose monitoring station
SPSS	Statistical Package for the Social Sciences
SRM	Standard reference materials
SWMB	Solid Waste Management Bureau

TCM Texas Climatological Model
THC Total hydrocarbons
TLV Threshold limit value
TRS Total reduced sulfur
TSP Total Suspended Paritculate matter

UG/M^3 (or $\mu g/m^3$) Micrograms per cubic meter
UNAMAP User's Network for Applied Modeling of Air Pollution
USEPA United States Environmental Protection Agency

V Vanadium
VALLEY Meteorological Model for concentrations on elevated terrain

WQB Water Quality Bureau

XRF X-ray fluorescence

YCAPC Yellowstone County Air Pollution Control

Zn Zinc

APPENDIX S

AQCR's and Area Codes

APPENDIX S

AQCR'S AND AREA CODES

As per the Clean Air Act, the Administrator for the EPA divided the State into geographic areas or air quality control regions (AQCR). These are as follows:

AQCR	Name
140	Billings
141	Great Falls
142	Helena
143	Miles City
144	Missoula

Figure AP-1-S shows the boundaries of Montana's five AQCR's on a map of the state.

Area codes for Montana are listed on Table AP-S-I.

AQCR's and area codes are used by data users for requesting or processing data.

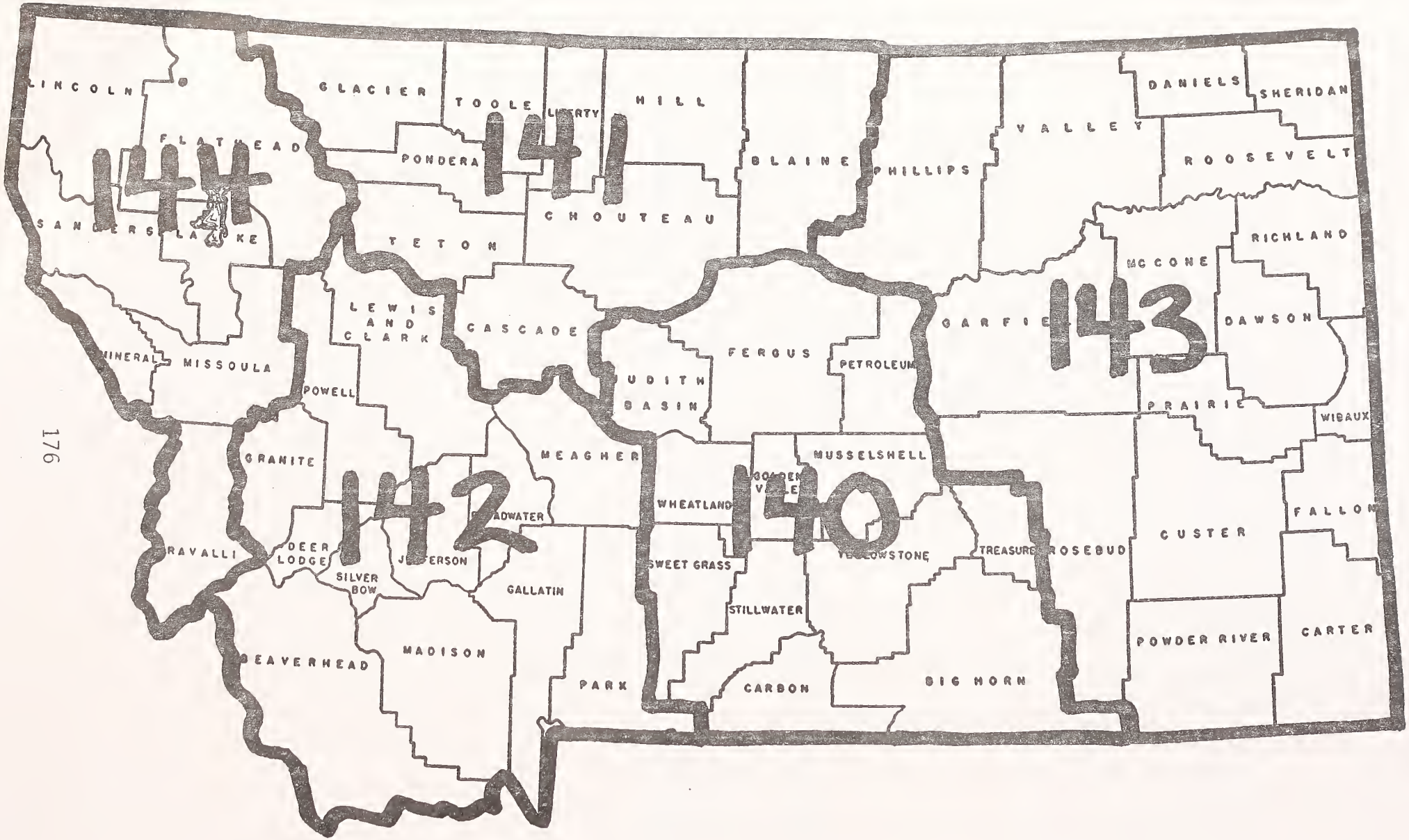

Figure AP-1-S

MONTANA AIR QUALITY CONTROL REGIONS

Table AP-S-I

MONTANA AREA CODES

0020 ANACONDA
0030 BAKER
0040 *BEAVERHEAD
0060 *BIG HORN
0080 BILLINGS

0100 *BLAINE
0120 BOZEMAN
0140 *BROADWATER
0160 BUTTE
0180 *CARBON

0200 *CARTER
0220 *CASCADE
0240 CENTERVILLE DUBLIN GULCH
0260 *CHOUTEAU
0270 COLUMBIA FALLS

0280 CONRAD
0300 *CUSTER
0320 CUT BANK
0340 *DANIELS
0360 *DAWSON

0380 DEER LODGE
0400 *DEER LODGE
0420 DILLON
0440 *FALLON
0460 *FERGUS

0480 *FLAT HEAD
0500 FLORAL PARK
0520 *GALLATIN
0540 *GARFIELD
0560 *GLACIER

0570 GLACIER NAT PARK
0580 GLASGOW
0600 GLENDIVE
0620 *GOLDEN VALLEY
0640 *GRANITE

0660 GREAT FALLS
0670 HAMILTON
0680 HARDIN
0700 HAVRE
0720 HELENA

0740 *HILL
0760 *JEFFERSON
0780 *JUDITH BASIN
0800 KALISPELL
0820 *LAKE

0840 LAUREL
0860 *LEWIS AND CLARK
0880 LEWISTOWN
0900 LIBBY
0920 *LIBERTY

0940 *LINCOLN
0960 LIVINGSTON
0980 *MC CONE
1000 *MADISON
1010 MALMSTROM

1020 *MEAGHER
1040 MILES CITY
1060 *MINERAL
1080 MISSOULA
1085 MISSOULA SOUTH

1090 MISSOULA WEST
1100 *MISSOULA
1140 *MUSSELSHELL
1160 *PARK
1180 *PETROLEUM

1200 *PHILLIPS
1220 *PONDERA
1240 *POWDER RIVER
1260 *POWELL
1280 *PRAIRIE

1300 *RAVALLI
1320 *RICHLAND
1340 *ROOSEVELT
1360 *ROSEBUD
1380 ROUNDUP

1400 *SANDERS
1420 SHELBY
1440 *SHERIDAN
1460 SIDNEY
1480 *SILVER BOW

1500 SILVER BOW PARK
1520 *STILLWATER
1540 *SWEET GRASS
1560 *TETON
1580 *TOOLE

1600 *TREASURE
1620 *VALLEY
1640 *WHEATLAND
1660 WHITEFISH
1680 *WIBAUX

1700 WOLF POINT
1720 *YELLOWSTONE
1740 YELLOWSTONE NAT PARK

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